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REPORT OF THE

OSART

(OPERATIONAL SAFETY REVIEW TEAM)

MISSION

to the

TRICASTIN

NUCLEAR POWER PLANT

FRANCE

14 to 31 JANUARY 2002

AND

FOLLOW-UP VISIT

17 to 21 NOVEMBER 2003

DIVISION OF NUCLEAR INSTALLATION SAFETY

OPERATIONAL SAFETY REVIEW MISSION

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PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Tricastin Nuclear Power Plant, France. It includes recommendations for improvements affecting operational safety for consideration by the responsible French authorities and identifies good practices for consideration by other nuclear power plants. Each recommendation, suggestion, and good practice is identified by a unique number to facilitate communication and tracking.

This report also includes the results of the IAEA's OSART follow-up visit which took place 22 months later. The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

Any use of or reference to this report that may be made by the competent French organizations is solely their responsibility.

FOREWORD

by the

Director General

The IAEA Operational Safety Review Team (OSART) programme assists Member States to enhance safe operation of nuclear power plants. Although good design, manufacture and construction are prerequisites, safety also depends on the ability of operating personnel and their conscientiousness in discharging their responsibilities. Through the OSART programme, the IAEA facilitates the exchange of knowledge and experience between team members who are drawn from different Member States, and plant personnel. It is intended that such advice and assistance should be used to enhance nuclear safety in all countries that operate nuclear power plants.

An OSART mission, carried out only at the request of the relevant Member State, is directed towards a review of items essential to operational safety. The mission can be tailored to the particular needs of a plant. A full scope review would cover eight operational areas: management, organization and administration; training and qualification; operations; maintenance; technical support; radiation protection; chemistry; and emergency planning and preparedness. Depending on individual needs, the OSART review can be directed to a few areas of special interest or cover the full range of review topics.

Essential features of the work of the OSART team members and their plant counterparts are the comparison of a plant's operational practices with best international practices and the joint search for ways in which operational safety can be enhanced. The IAEA Safety Series documents, including the Nuclear Safety Standards (NUSS) programme and the Basic Safety Standards for Radiation Protection, and the expertise of the OSART team members form the bases for the evaluation. The OSART methods involve not only the examination of documents and the interviewing of staff but also reviewing the quality of performance. It is recognized that different approaches are available to an operating organization for achieving its safety objectives. Proposals for further enhancement of operational safety may reflect good practices observed at other nuclear power plants.

An important aspect of the OSART review is the identification of areas that should be improved and the formulation of corresponding proposals. In developing its view, the OSART team discusses its findings with the operating organization and considers additional comments made by plant counterparts. Implementation of any recommendations or suggestions, after consideration by the operating organization and adaptation to particular conditions, is entirely discretionary.

An OSART mission is not a regulatory inspection to determine compliance with national safety requirements nor is it a substitute for an exhaustive assessment of a plant's overall safety status, a requirement normally placed on the respective power plant or utility by the regulatory body. Each review starts with the expectation that the plant meets the safety requirements of the country concerned. An OSART mission attempts neither to evaluate the overall safety of the plant nor to rank its safety performance against that of other plants reviewed. The review represents a 'snapshot in time'; at any time after the completion of the mission care must be exercised when considering the conclusions drawn since programmes at nuclear power plants are constantly evolving and being enhanced. To infer judgements that were not intended would be a misinterpretation of this report.

The report that follows presents the conclusions of the OSART review, including good practices and proposals for enhanced operational safety, for consideration by the Member State and its

competent authorities. It also include the results of the follow-up visit that was requested by the competent authority of France for a check on the status of implementation of the OSART recommendations and suggestions.

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INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the Government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited the Tricastin Nuclear Power Plant (NPP) in France, from 14 to 31 January 2002. The purpose of the mission was to review operating practices in the areas of Management Organization and Administration; Training and Qualification; Operations; Maintenance; Technical Support; Radiation Protection; Chemistry; and Emergency Planning and Preparedness. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The Tricastin OSART mission was the 114th in the OSART programme, which began in 1982. The team was composed of experts from Canada, the Czech Republic, Germany, Mexico, Spain, Sweden, the United Kingdom, the United States of America, and France the host plant peer, together with the IAEA staff members and observers from China, Pakistan and the IAEA. The collective nuclear power experience of the team was approximately 320 years.

Before visiting the plant, the team studied information provided by the IAEA and the Tricastin plant to familiarize themselves with the plant's main features and operating performance, staff organization and responsibilities, and important programmes and procedures. During the mission, the team reviewed many of the plant's programmes and procedures in depth, examined indicators of the plant's performance, observed plant conditions, work in progress, and held in-depth discussions with plant personnel.

Throughout the review, the exchange of information between the OSART experts and plant personnel was very open, professional and productive. Emphasis was placed on assessing the effectiveness of operational safety rather than simply on the content of programmes. The conclusions of the OSART team were based on the plant's performance compared with IAEA safety standards and with good international practices.

At the request of the Government of the France, the IAEA carried out a follow-up to the Tricastin OSART mission from 17 to 21 November 2003. The team comprised of four members, one from Spain, one from UK and two from the IAEA. All four reviewers in the team had been members of the original OSART team. The purpose of the visit was to discuss the action taken in response to the findings of the OSART mission.

During the five days visit, team members met with senior managers of the Tricastin Nuclear Power Plant and their staff to assess the effectiveness of their responses to recommendations and suggestions given in the official report of the Tricastin OSART mission. The team provided comments on the responses, provided some additional suggestions for improving response actions and categorized the status of response actions. Definition of categories of response status and a summary of the results in a quantitative manner are provided at the end of this report.

MAIN CONCLUSIONS

The OSART team concluded that the managers of Tricastin NPP are committed to improving the operational safety and reliability of their plant. This commitment was clear when observing the improvements in plant conditions, work being performed and discussions with plant staff. The team found good areas of performance, including the following:

- The professionalism of the staff which is enhanced by a strong training programme;
- The management initiatives and tools to achieve rapid and broad improvements in a number of areas has significantly improved over the last few years;
- Strong leadership and control of safety related activities coupled with a sense of management planning is communicated professionally and consistently by the management team and now showing positive results in key areas;
- The material condition of Units 1 and 2 and the housekeeping have dramatically improved, with thorough plans to improve unit 3 and 4 at least to the same standards.

The team offered a number of proposals for improvements in operational safety. The most significant proposals include the following:

- Despite the improvements at the plant in the last two years, there continues to be problems associated with adherence to policies, procedures and instructions. Although workers are trained to know what is required of them, individuals sometimes feel free to determine for themselves when rules should be followed. Some managers do not always intervene to correct such performance.
- The foreign material exclusion practices at the plant are weak.
- EDF has not developed a clear corporate policy that prohibits the consumption of alcohol prior to work or during the workday in accordance with good international practice and IAEA safety guidance.

The Tricastin plant is going through a period of widespread transition. Three years ago the performance indicators for the plant showed weaknesses in many areas. Today the indicators show much better performance. In other cases it is too soon to see improvement. Because of this transition period, the team provided recommendations in some areas where the plant has already embarked on aggressive improvement activities. The team encourage the plant to maintain a long term and tenacious attitude as it pursues improvements and also periodically assess the success and make necessary corrections.

An important element of the OSART review is the identification of those findings that exhibit positive and negative safety cultural aspects of operational safety performance. The OSART team used the guidance provided in INSAG-4, INSAG-13 and IAEA Safety Report Series No. 11 to assess various organizational and technological aspects of operational safety culture at the Tricastin NPP. The team concluded the following:

- The staff members are not always the drivers of change, the expectation is often that the change is always from the top down. Common feeling is not yet that some change comes from the bottom up, although management aims at involving people through Total Quality Management.
- Some standards are not clearly set and not adopted by some staff and managers. Cultural issues may hinder future development in this area and needs to be accounted for.

- There appears to be an insular environment with little knowledge of industry best practice outside of EDF.
- In some areas there appears to be a culture of compliance rather than a culture of striving for excellence.

On the other hand, the team recognized the good pride of their nuclear power plant that the management and staff felt and was impressed with the staffs professionalism and their desire to improve. Senior management should continue to encourage and reward the staff's behavior in this area.

The team recognises that several actions are already in place to address some of the above proposals. The Tricastin NPP management expressed a determination to improve in the areas identified by the team and indicated a willingness to accept an OSART follow up visit in about eighteen months.

FOLLOW-UP MAIN CONCLUSIONS

During the OSART mission in the beginning of 2002 there were several observations that supported the fact that plant staff as well as contractors did not always follow policies, procedures and instructions, although they have been trained to know what was required of them. There were also observations that staff members were seldom drivers of change and most improvement initiatives were coming top down. Furthermore, it was clear that the plant was in an insular environment with little knowledge of best practice outside of EDF. On the other hand the OSART team also recognized the staff's willingness to improve.

After the OSART mission, the Tricastin management adopted an approach of trying to define the root causes to their issues in all areas rather than simply working on the individual issues. This approach created a management oversight view, that was used to develop strategies for how to work with the outcome of the OSART. This had the integrated effect that work with some of the issues in the MOA area widely contributed to the work on resolution of issues in other areas.

With the above mentioned approach, the plant identified the need for several common activities, for example:

- clarify reference standards for several areas and also to create simplified communication means to get all concerned aware of what's expected from them
- strengthening thoroughness in performance of activities as well as a questioning attitude
- widespread use of cross functional groups with the involvement of staff and managers have developed new reference standards and simplified them to make communication effective.
- strengthening the supervision, coaching and monitoring in the field by supervisors and managers
- extensive benchmarking to learn and understand how others approach similar problems as defined by the OSART team.

The plant has developed a systematic process for working with the OSART issues, where the above activities are included.

The OSART follow up team found considerable improvements in several areas.

For example:

- Housekeeping and material condition has continued to improve, still more remains to be done and the plant is well aware of this and has reserved the necessary resources for doing this in 2004.
- Enhanced field observation in operation, maintenance and radiation protection has led to improvements in these areas that is clearly seen in indicator trends
- Industrial safety posting has improved and the staff is more consistent in following the rules
- The plant's solution on seismic constraints for lead shielding is excellent and could serve as a model for the industry
- The Fyrquel issue has been approached in an exemplary way, which makes Tricastin a leading plant in the EDF nuclear fleet.

The plant has made notable improvements in many other areas and is well aware that there is always room for more, in their adopted continuous improvement approach. An important enabler to assure continuity is the involvement of field workers in Tricastin.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

1.1 CORPORATE ORGANIZATION AND MANAGEMENT

Tricastin NPP is a four-Unit PWR plant of 900 Mwe each, situated in Provence, southern France and is operated by Electricité de France (EDF). The plant manager reports to the Director of Nuclear Power Generation Division, (DPN) who in turn reports to the Associate Director-General. The plant manager attends meetings held by the Nuclear Generation Division located at EDF headquarters in Paris.

The Nuclear Generation Division is supported by:

- Corporate FTC departments
- Corporate technical support departments, covering operations, chemical, metallurgical and engineering support for operations.

Engineering support, which is accountable to the Associate Director-General via the Engineering Division & Services, is also available for supporting all the nuclear sites, including Tricastin NPP.

A detailed job description for the plant manager is signed by the Director of Nuclear Power Generation Division, (DPN), which formalizes his authority.

Corporate resources are extensive to support the Nuclear Generation Division's objective to safely operate the EDF nuclear fleet. The Operational safety organization within EDF has four layers of safety committees:

- a) Nuclear safety committee (CSN), chaired by the president of EDF (national)
- b) Operational safety committee (CSNE), chaired by Director of nuclear generation division. (national) – Tricastin plant manager attends this meeting.
- c) Safety review committee (CSN), safety technical committee, COMSAT plus GTS. Chaired by the plant manager, and/or the associate directors(SITE).
- d) Daily safety meetings, chaired by the on site shift manager.

The auditing arrangements for each level of the safety committees provides for safety at every level.

The objectives of the Nuclear Power Generation Division (DPN) are to produce energy:

- Safely (technical and human reliability)
- Cleanly (release and waste management)
- Cost effectively (cost control)

DPN along with its nuclear fleet has a policy of openness and transparency in its relations with local communities, the media and the regulator.

EDF does not have a comprehensive strategy or policy that prohibits the consumption of alcohol during the workday, including on Nuclear Sites. As an example, alcohol is served in the plant restaurant limited to 25cl for wine or 33cl for beer. The team provided recommendations for the plant and the corporate organization on this issue.

1.2 PLANT ORGANIZATION AND MANAGEMENT

The plant has approximately 1280 EDF employees. In addition, many contractors are normally on site for outage work.

The plant's senior management team is comprised of the plant manager with three associate directors covering power operation, outages and logistics. In addition, they are supported by six management advisors. The advisory functions include plant safety/quality, plant technical, communications, human resources, administrative advisor and a quality management advisor.

The senior management team is supported by ten departments, that include operations, chemistry & environment, industrial safety & radiological protection, mechanical maintenance, I&C/electrical maintenance, modifications, site logistics, nuclear engineering, co-ordination and buildings & property. Each of the Associate Directors has responsibilities for some departments associated within their core area of responsibility.

The plant has support from DPN and the corporate technical and engineering departments.

The management team has developed and deployed its strategic objectives required to ensure the future success of the plant.

Management key objectives are to:

- a) Design and deploy an integrated and comprehensive management system within quality-managed processes (The Information Technology (IT) systems were improved on site to match the processes).
- b) To ensure staff at all levels understand the issues and strategy and were offered the opportunity to participate in the deployment.

The plant has improved in a number of areas since 1999 as demonstrated by performance indicators, however continued effort is required if additional improvements are to be realized, so the plant can achieve its own goals in performance excellence. Initiatives such as the advanced recruitment policy (GAEC) and human performance group development, all supported by management, will assist in raising the standards throughout the workforce.

The plant has also pursued an aggressive programme to improve the housekeeping and material condition of all four units. This programme has been implemented in units 1 and 2, but the work in units 3 and 4 remains outstanding. The team made a recommendation to continue the programme and to assure sustainability of actions implemented.

Demonstrable progress has been made to embed the policy of "Questioning attitude" and "Thoroughness" into the improvement of the workforce. Significant management processes have been initiated at the plant. While these processes are beginning to show success, there remains a gap between the expectation of managers and the results observed. The team provided a recommendation in this area.

The turnover of staff for the next 10 to 12 years will be significant when compared to the history of the plant. The reduction in experience across the workforce from its current high level is reviewed to ensure that any effects do not impact on nuclear safety.

Nuclear safety considerations are paramount throughout the plant and its operation. The structures and working methods contain elements specifically designed to ensure that a safe operational status is maintained at all times, including the unit on outage. Management need to remain diligent to ensure that these measures remain effective.

1.3. QUALITY ASSURANCE PROGRAMME

The principles of the nuclear safety policy are derived from the EDF president, to the nuclear plant generation division, to the plant manager and finally the shift manager.

Copies of the EDF president's letters on nuclear safety policy are issued to all staff along with an accompanying letter from the plant manager. The safety policy has seven principles:

- To carry the public confidence with respect to nuclear power.
- Safety culture as per INSAG 4
- Compliance
- Improvement via Total Quality Management (TQM)
- Comparison of performance indicators with WANO indicators
- Balance the economic realities with available resources
- Transparency throughout.

All of these principles are in the Safety Handbook issued to all employees of EDF.

The Quality management advisor heads the quality management advisory unit.

The department carries out numerous audits to QA standards. The detail is contained in the site quality manual, which sets out the structures and systems needed to ensure a quality document process. The audits cover some 34 themes, each of which has an owner and each is audited every 5 years as part of a rolling programme.

The integrated quality processes link together, such that the organizational documentation, which amount to 694 documents, have owners, are audited, updated and tracked via the integrated computer system.

1.4. REGULATORY AND OTHER STATUTORY REQUIREMENTS

The roles and responsibilities of the regulatory body were covered in the presentation at which representatives of the site and the regulatory body (DSIN) were present.

Tricastin NPP has two regulatory inspectors identified for the site. They have permanent regional offices in Lyon. The regulator does not have an office on site but is provided with facilities as required on occasions.

The regulator carries out at least 20 planned inspections per year and notifies the site approximately 2 weeks before the inspection. This allows the site to gather information pertinent to the area or procedures under inspection. In addition to this the regulator will carry out a number of additional inspections particularly for the unit on outage.

In 2001, 13 work site and 13 topic-based inspections were carried out. About 25% of all inspections are not announced. The unit on outage inspections are in addition to the planned inspection regime.

Any findings from the inspections are dealt with through formal processes with responses provided by the plant, normally within a 2-month period. The responses and any subsequent actions are tracked by the site.

Communications concerning any issue between the site and the regulator are well established and cover a range of situations including the requirement to inform the regulator immediately, following a significant event.

The regulator attends technical meetings periodically, which allows informal discussions to take place on a number of subjects. For example, the regulator is showing an encouraging interest in the benefits of Human Factors investigations.

The regulator emphasized the progress the plant has made in the last 3 years, in particular, its openness policy.

Although the plant and the regulator have a good working relationship, the regulator ability to maintain its safety independence at all times, was discussed. One of the means by which regulatory independence is maintained, is the use of the other site regulatory inspectors who carry out a selection of the inspections at Tricastin NPP, which in effect, audits the inspection standards of the nominated site regulatory inspectors and the plant, at the same time.

1.5. INDUSTRIAL SAFETY PROGRAMME

It is encouraging that the plant's industrial safety record has made notable improvement over the last year.

The industrial safety department is very active in the pursuit of improvement in industrial safety. Accidents and injuries are logged in a database, "Ariane". The plant has a health & safety committee which meets regularly. The Industrial safety department operates a low-level events system as one of the mechanisms in improving industrial safety. The department is responsible for identification, authorization and use of all chemical products on site, ("OLIMP" data base) which will be loaded onto the site network in approximately two months.

Numerous communications media are used to promote good industrial safety practices, including the distribution of an industrial safety magazine.

Whilst industrial safety has improved, further improvements are required particularly in the use of personal protective equipment, such as head, ear, eye and hand protection. Management in the handling of substances such as Fyrquel, need to be improved, along with the clarity and enforcement of the smoking policy. The team made recommendations in this area.

Policies are in place to improve industrial safety but they are not always adhered to by workers in the field. Further increases in the rigorous enforcement of the industrial safety policy are required to improve the acceptance of international industrial safety practices.

1.6. DOCUMENT AND RECORDS MANAGEMENT

The plants documentation processes and systems have been designed around the management strategy and policies. The detailed structure of the processes is based on QA/TM principles. The quality management advisory unit (MSQ) supports and audits the quality standards within this area, which includes common formats across a range of document types.

All documentation is managed through the comprehensive and integrated computer system, which means that updates and modifications to documentation can be carried out efficiently and by the person or section responsible identified in the process.

The workforce accesses documentation via the computer system at the point of work. This ensures that the documents are the latest issue.

The cross referencing of documentation is not yet fully comprehensive. This is ongoing and will be completed before the end of 2002.

STATUS AT OSART FOLLOW-UP VISIT

The OSART team identified six issues in the MOA area, all of them were recommendations. The OSART follow up team judged that four of the recommendations were progressing satisfactorily and two were found to reach the level of resolved according to the OSART follow up definition.

The Tricastin management has adopted an approach of trying to find the root causes to their issues in all areas and then from that oversight view develop strategies to work with these root causes. This has the effect that work with some of the recommendations in the MOA area will contribute widely to the work with issues in other review areas. The issue on “Thoroughness” and “Questioning Attitude” is such an example where the effect of implemented initiatives supports the efforts on reaching solutions on other issues.

Both the EDF corporate and the plant have taken initiatives to resolve the two recommendations on the well known alcohol issue. The director of DPN has decided to ban alcohol on all EDF nuclear sites and to rewrite corporate rules on the matter before end of 2004. The plant manager has at the site banned the consumption of alcohol, updated internal instructions, raised the awareness of risk with alcohol consumption and encouraged managers and supervisors to observe their staff behavior.

The plant has continued and strengthened its activities to improve housekeeping and material condition standards by:

- clarifying reference standards and increasing staff accountability
- more aggressively addressing deficiencies
- strengthening supervision and monitoring

Refurbishing of plant installations has continued in units 3 and 4, some areas in unit 4 will be refurbished after the ten-year outage in 2004. The plant has taken several steps to assure sustainability in their efforts to get the total plant up to international standards, in allocating resources in the mid-term budget, assigning operation as the owner of the installations and also permanently placed the minor maintenance team in operation. Plant tours during the follow up indicate considerable improvements since the OSART mission, but shows also that some gaps have to be filled both in the detection of sub-standards and maintaining efforts to keep up the standards reached.

Since the OSART, further development of initiatives in improving the thoroughness and questioning attitude has been done: indicator programmes, self-assessment, pre-job briefings, extensive benchmarking and risk management, only to mention some activities. Cornerstones in the success, that now can be seen, are the extensive involvement of staff, the use of cross-functional working groups, benchmarking and the strong involvement of management in ongoing improvements. The management’s coaching of thoroughness in the field as well as the recognized and simplified set of reference standards are important contributors to the improving results. Also the now more frequent evaluation of indicators raises the awareness of the need to anticipate of new actions or the strengthening of existing actions. Continuous monitoring of introduced initiatives is essential to sustain reached results and maintain a continuous improvement approach.

The plant has in an appropriate way defined the root causes and implemented actions in clarifying the standards, improving the industrial safety posting, increasing management involvement and continuous by raising the awareness of industrial safety hazards that is now showing improving results in lowering the accident rate. The trend must be kept under

observation and staff's compliance with the standards regularly checked in the field. Still some evidence was found, that were not up to plant reference standards.

The Tricastin plant is the leading plant in EDF to develop the new approach to handling and use of Fyrquel, impressive improvements have been made since the OSART by development of new reference standards and to attack the concerns with the use of Fyrquel and associated technical problems. A special leaflet has been developed, with support of medical staff at Tricastin, that covers the concerns with Fyrquel, which is now shared with all other plants in the EDF nuclear fleet. Solutions to the technical problems have been developed and are now also shared with the other plants. A long-term action plan is under development and includes a search after less hazardous high temperature hydraulic oil. The approach of Tricastin plant to resolve this issue is exemplary.

DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

1.1. CORPORATE ORGANIZATION AND MANAGEMENT

1.1(1) Issue : EDF and the nuclear plants within EDF do not have a comprehensive strategy or policy that prohibits the consumption of alcohol prior to work or during the workday, including on nuclear plant sites.

Alcohol (wine and beer, limited to 25cl for wine and 33cl for beer) is served in the restaurant at Tricastin NPP.

6 previous OSARTs at other EDF sites have raised this as a concern.

At the time of the OSART follow-up mission to the 6 previous sites, 3 had fully implemented the recommendation and 3 had still to implement the recommendations fully.

Serving of alcohol on site condones the consumption of alcohol off site during the working day.

The current policy for sites, which still have access to on site alcohol, is inconsistent with safe nuclear operations by its support of consumption of alcohol by its staff, during the working period.

Recommendation: EDF should establish and issue a clear corporate alcohol policy directive to reflect acceptable international standards within its nuclear sites.

Recommendation: Tricastin NPP should establish and issue a clear directive on alcohol policy to reflect acceptable international standards within its nuclear site pending the issue of a corporate directive.

EDF Corporate Response: The IAEA recommendation to ban the consumption of alcohol on French nuclear power plants was conveyed to headquarters via the OSART report. The plant manager discussed the matter at the beginning of March 2003 with Claude Jeandron (DPN Associate Director with special responsibility for nuclear safety).

At a meeting held on July 2nd, the matter was discussed by the Plant Safety Review Committee (CSNE), a corporate body whose role it is to reach decisions on major issues of nuclear safety policy, and which brings together all French nuclear power plant managers. On this occasion, 7 plants had totally banned the consumption of alcohol, while 3 are set to ban it (more than 50% of plants). The CSNE obtained a majority vote for the banning measure. The proposal to ban alcohol on all NPPs in France was discussed during the DPN Senior Management Team meeting on the 29th of September 2003, chaired by Laurent Stricker. It was decided that the Corporate Instruction No 29 should be rewritten and that the consumption of alcohol in any form should be banned on all NPPs in France. This measure will be effective and applied on all sites at the latest by the end of the year 2004.

Plant Response:

The recommendation to ban the consumption of alcohol at Tricastin NPP was discussed on several occasions by the Senior Management Team and Extended Plant Management Committee.

A total ban on alcohol consumption was finally adopted at the end of December 2002 by Bernard Magnon, the plant manager, who decided to incorporate it into site rules and internal procedures.

The rule was submitted to staff and union consultative committees (CMP, CHSCT) and then sent to the Labour Inspector. Once it had completed this circuit, the on-site rule was enforced and all consumption of alcohol banned at Tricastin NPP.

The introduction of this ban was accompanied by the following measures :

- Staff were provided with information on alcohol-related risks while performing sensitive activities, and on the need to begin their shift without having previously consumed alcohol (road safety regulations as a minimum requirement),
- Measures were taken to raise the awareness of site security personnel regarding their duty to detect any alcoholic beverages having possibly been placed in bags.
- Measures were taken to raise the awareness of managerial staff regarding their duty to monitor the behaviour of staff coming on shift, and to detect any potential deviations due to alcohol consumption prior to starting work.

IAEA comments:

The team in the original OSART mission made two recommendations in this area, the first was directed to the corporate level and advised the EDF corporate to establish and issue a clear corporate alcohol policy directive to reflect acceptable international standards within its nuclear sites. Steps have been taken in this direction by a discussion in the Plant Safety Review Committee (CSNE) resulting in a proposal to the DPN director to decide on a total ban of alcohol consumption at all EDF plants. Such a decision has been taken in the DPN Senior Management Meeting 29th of September with directions to rewrite the corporate rule IN 29 with a plan to have it implemented at all plants before the end of 2004.

Conclusion: Satisfactory progress to date

IAEA comments:

The second recommendation on the same topic was directed to the Tricastin plant and here the matter has been discussed in the Senior Management Meetings and Extended Plant Management Committee in 2002. The plant manager took a decision on a total ban of alcohol consumption on Tricastin site in the end of December 2002. The internal rules (Règlement Intérieur) have been updated, staff and unions have been informed. Further, instructions for security staff and management have been updated and reinforced. Several different leaflets have been developed on the risk with consumption of alcohol and they have been presented for staff and supervisors. Managers' awareness has been raised in the observation of their subordinates' behaviors. Such awareness raising is also planned to be repeated with appropriate intervals.

Conclusion: Issue resolved.

1.2. PLANT ORGANIZATION AND MANAGEMENT

1.2(1) Issue: Housekeeping and material condition standards in units 3 and 4 needs improvement and are not at the same level as has recently been reached in units 1 and 2.

Tricastin has pursued an aggressive programme to improve the housekeeping and material condition of all four units. This programme has been implemented in units 1 and 2, however significant shortcomings remain in units 3 and 4. See detailed findings in the Maintenance and Operations sections of the report.

Milestones for completing activities in units 3 and 4 are :

- Painting of walls, floors, ceilings and steelwork commencing March through to mid year 2003. A detailed study has been carried out to support the policy, not only for units 3 and 4, but for other key areas across the site. Budgetary provision has already been allocated for completion of the whole programme.
- Unless the refurbishment of units 3 and 4, along with other key areas across the site is carried out, it will be difficult to sustain the improvements already achieved on units 1 and 2. (see issue 3.2 (1) and 4.6 (1), material conditions).

Recommendation: The plant should continue to schedule into its business plans, the upgrade requirements for housekeeping and material condition in units 3 and 4. The plant should also focus on maintaining areas that have been refurbished by considering the introduction of veritable housekeeping walk downs.

Plant Response:

In 2002, the plant continued its efforts at improving plant condition, focusing on three aspects: refurbishment, clarification of reference standards and increased staff accountability, supervision and monitoring.

REFURBISHING PLANT INSTALLATIONS AND ADDRESSING DEFICIENCIES

The plant condition status reached at the time of the follow-up visit is the following:

- Units 1 and 2, which had been refurbished before the OSART mission, were kept using very little effort in line with the standard.
- For Unit 3, efforts were done to put it up to the standard (turbine hall, electrical building rooms, nuclear auxiliary building rooms), except oil tank room (GGR) and some materials like ASG pumps who could'nt be done during outage and that are planned in 2004.
- For Unit 4, the plant has begun to refurbish some rooms in the electrical building (mainly model rooms) and the turbine hall which was repainted for the unit 3 and 4 at the same time. The remaining work on rooms housing electrical and nuclear equipment of unit 4 has been scheduled after the 2nd ten-year outage, which will take place in 2004 ;

The most significant efforts were:

- Installation of water retention devices, drainage systems and leak-recovery systems;
- Additional lighting;
- Repairs to cable trays and wall penetrations;
- Improved sign-posting and labelling.
- In the course of 2002 and 2003, the quick minor-maintenance team, already up and running during preparations for the OSART mission and consisting of

seconded plant staff from departments and contractor companies, continued to rectify deficiencies concerning non-safety-related equipment :

- On units 0-1-2 et 9: 1193 deficiencies detected and 890 fixed in 2002
- On units 3-4-8 : 2736 deficiencies detected and 1890 fixed in 2002
- On units 0-1-2 et 9 : 313 deficiencies detected and 178 fixed in the first half of 2003
- On units 3-4-8 : 994 deficiencies detected and 635 fixed in the first half of 2003

In the first half of 2003, the number of deficiencies detected on the plant was cut by 60%. The team, which has proven its efficiency in maintaining good plant condition, will become a permanent fixture within the plant organisational structure.

CLARIFICATION OF REFERENCE STANDARDS AND INCREASED STAFF ACCOUNTABILITY

Three types of action have contributed to the achievement of this goal:

- Drafting of a set of ‘plant condition’ reference standards, designed to identify deficiencies and set up ‘model areas’ serving as a reference;
- Appointment of 14 ‘plant area supervisors’ (1 per operations shift team), to whom responsibility is assigned for all plant areas, which for purposes of easier identification and ownership, are divided up into 56 zones;
- Half-days devoted to housekeeping, which, in 2002, involved (and therefore raised the awareness of) more than 400 people, focusing on the following topics: housekeeping - addressing deficiencies - labelling/posting of information - cleaning/waste removal, etc.
- Specific indicators are used to track the progress of corrective actions, classified under the headings ‘housekeeping’, ‘labelling’ and ‘general’ on each unit.
- This initiative was accompanied by training actions and measures designed to raise awareness, in order to :
 - o Improve the ability of field operators to identify deficiencies ;
 - o Gradually raise reference standards ;
 - o Enhance management skills in enforcing these expectations in the field.

In order to raise contractor awareness, housekeeping and environmental issues were addressed at outage-planning meetings (43 companies involved).

Supervisors of maintenance activities involving a degree of risk are starting to implement a start and end-of-job report system focusing on plant condition.

SUPERVISION AND MONITORING

The plant has instituted :

- Field inspections conducted by management, designed to close the loop in plant area supervision: first-level checks by operations shift teams in order to monitor in-the-field processing of discrepancies detected in all areas; second-level random checks by operations department senior management.
- Routine inspections conducted by an on-call team (all specialisations) every Friday morning. Its aim is to gauge the effectiveness of systems in place. In 2002, 50 inspections took place.

With regard to contractor supervision, justification for the introduction of a supervisory position in 2001 was confirmed and reinforced as far as plant condition was concerned. In 2002, a training course was introduced to raise the awareness of

those dealing with plant- condition deficiencies and other reference standards (environment, industrial safety), using a special video produced by Tricastin, thus partially providing a response to the suggestion 2.7(1).

KEEPING PLANT CONDITION UP TO STANDARD

The plant has been making important efforts for the last three years on plant condition in order to reach international reference standards. This level will be reached for the 4 units by the end of 2004, the whole work package being already planned and a budget allocated.

With the aim of ensuring that this situation will be maintained, the Plant has decided (and written into its medium-term plan) for the years 2004 to 2006 :

- To keep in place the minor maintenance team which has proven itself in dealing with minor deficiencies, and incorporate it into the operations department which is ‘owner’ of the installation,
- To raise and measure the professional standards of plant area supervisors on a regular basis (1 per shift operations team) and their field operators,
- To accurately forecast the overall budget required to maintain plant condition on an annual basis, after initial refurbishment (budget already agreed for 2004 and established for 2005),
- To improve the quality of job close-outs
- And continue with checking and monitoring activities introduced in 2003 :
- Routine plant tours carried out by on-call teams every Friday in order to identify any shortcomings in the way that housekeeping is managed and to gauge the difficulties encountered in terms of implementation and ownership in the field
- Tours conducted by operations department managers
- Monthly trending of housekeeping indicators within the power operations process

Management at the plant is convinced that a high standard of plant condition has a powerful impact on the plant’s operational and industrial safety results, and more generally speaking on the quality of maintenance activities and workers’ thoroughness on a day-to-day basis.

IAEA comments:

The plant has continued and strengthened its activities to improve housekeeping and material condition standards by:

- clarifying reference standards and increasing staff accountability
- more aggressively addressing deficiencies
- strengthening supervision and monitoring

Refurbishing of plant installations has continued in units 3 and 4, some areas in unit 3 and 4 will be refurbished after the ten-year outage in 2004. The plant has taken several steps to assure sustainability in their efforts to get the total plant up to international standards, in allocating resources in the mid-term budget, assigning operation as the owner of the installations and also permanently placed the minor maintenance team in operation. Furthermore, several other initiatives, as described above in the plant response, have been introduced with large involvement of staff and management, that have a potential to raise the housekeeping and material condition standards to an international accepted level in a reasonable time frame.

Plant tours during the follow up indicate considerable improvements since the OSART mission, but show also that some gaps have to be filled both in the in the detection of sub-standards and maintaining efforts to keep up the standards reached.

Conclusion: Satisfactory progress to date.

1.2(2) Issue: Although significant management processes have been initiated at the plant, there remains a gap between the expectation of managers and the results observed. The team noted that demonstrable progress has been made to embed the policy of “Questioning Attitude” & “Thoroughness” into the improvement of the workforce, however the following was observed :

- In the Unit 1 Active ventilation system a member of the maintenance department entered the ventilation plant room without closing the door, bypassing the Iodine filter. This was raised by the plant as a significant event, as he did not follow the requirement for work and access to this area.
- A safety related temperature sensor was not routinely maintained inside its normal maintenance period. It was maintained inside its safety period limit. However the plant does not monitor the ratio of safety related plant equipment maintained inside the normal maintenance period versus the maintenance completed between the technical & safety periods.
- The plant did not identify or question the need for the temporary shielding adjacent to seismically qualified spent fuel cooling pumps to be seismically assessed.
- Some workers do not correct industrial safety problems when other workers are involved.
- Some plant deficiencies do not have deficiency tags.

If the policy of “Questioning Attitude” and “Thoroughness” is not fully accepted at the working level, the plant could miss opportunities to correct problems with operational safety.

Recommendation: The plant should continue to tenaciously pursue its programme to instill a “Questioning Attitude” and a “Culture of Thoroughness” in all plant workers. The process requires a long period of time before it is embraced throughout the organization. Periodically throughout the period the plant should review the success of the programme to ensure that high performance is sustained and make necessary enhancements to the programme to meet management expectations and to be in line with IAEA safety standards and good international practice.

Plant Response:

This response follows on from efforts undertaken by plant management as a whole to clarify its expectations and improve the way in which they are taken on board in the field, as well as to enhance accountability and questioning attitudes towards relevant issues. The plant has addressed these issues pragmatically and initiatives have been based on a concrete approach, developed by the people concerned, particularly through the setting up of cross-functional working groups.

ENHANCING A CULTURE OF THOROUGHNESS

The working group, which goes by the name of “thoroughness in the work place” continued its efforts during 2002 and in October of the same year and submitted its conclusions to the entire Senior Management Committee, which decided to include a number of the group’s proposals in the business plan for 2003-2005, concentrating on :

- Development of self-assessment and internal assessment programmes. The Plant has started self-assessment using Corporate Inspection Department reference standards. All Plant departments have started to position their activities with respect to Corporate Inspection Department performance requirements and criteria identifying: strong points, weak points and any good practices for each field of the reference standards (Safety Management, Operations, Maintenance, Outages, Radioprotection, Technical Support, Environment, Fire fighting, Material Condition). Concerning the weak points, departments must implement an action plan in order to improve their fields as part of the preparation for the EGS in 2004. The effective implementation of this initiative by Maintenance has enabled the strong cooperation of Mechanical Maintenance and I&C (MCR & AEI) to be continued. For some objectives (examples: safety assessment by safety engineers, management of radioactive source rooms) cross-self-assessment is carried out with Cruas NPP.
- Intensifying efforts to develop operational communication ;
- Inclusion of the expectation of thoroughness in the new individual appraisal formula introduced at the end of 2002.
- In addition, the ‘Safety 2003’ priority sheet included in the business plan places special emphasis on the subject of thoroughness and lists the following goals :
 - Describe tangible processes to improve thoroughness ;
 - Monitoring in the control room and in the field ;
 - Changes in reactor operating modes ;
 - Tagging activities ;
 - Work packages and associated risk assessments ;
 - Line-ups.
 - Improve responsiveness to correcting our deficiencies, in order to avoid ending up with a new informal standard and to guarantee compliance with reference standards, whether this entails the implementation of corporate prescriptions or optimal processing of equipment deficiencies.

When the Plant worked on what it considered to be the root causes of the IAEA recommendations: the lack of sharing our requirements, it became apparent that the lack of sharing was due to the fact that our reference standards were too complicated, too difficult to access and impossible to memorize for workers.

We therefore simplified the most important reference standards for the Plant, in all areas (Radiation protection, safety, operations, housekeeping.....) using the same method each time:

- analysis in working groups of fields operators who use the reference standards, an expert in the field and a manager
- proposal for the simplified reference standards document made by the staff to be shared within the department(s) concerned
- presentation of the simplified reference standards during specific or existing meetings, for instance (pre-outage meetings, industrial safety meetings within the departments)

Verification of the application of the simplified reference standards by line management (observation of working practices, analysis of deviations, reporting of difficulties in application).

Progress of the medium-term business plan is periodically reviewed by the Senior Management team.

Lastly, efforts have been stepped up in two additional areas where work is being done to enhance thoroughness at work :

- Audits, with the introduction of an “organisational” audit plan at plant level, supplementing the audits and independent checks specifically conducted by the Safety/Quality department.
- Monitoring activities, extending the scope of the plant monitoring plan, which now covers the following areas: safety-quality, management, human resources, finances and management control.

Coaching of thoroughness in the field

As a result of behavioural deficiencies observed on the plant, presence in the field was significantly stepped up in 2003 through the implementation of a coaching initiative to promote thoroughness in the field, resulting in the daily presence at work sites of managers accompanied by people practised in field supervision. The notion of thoroughness focused on a limited number of basic expectations with regard to industrial safety, work site condition and fire prevention.

Since the implementation of this measure (May 2003), more than 140 work sites visits were organised, involving around 200 people specially trained in detecting and correcting deficiencies in the work situation. The results of this initiative were measured: presence in the field reduced the number of deficiencies observed significantly and the performance results on Safety, Radioprotection, radiological and cleanliness and work site tidiness have greatly improved.

ENHANCING A QUESTIONING ATTITUDE

In order to enhance the staff’s questioning attitude, three major projects were initiated in 2002 and are continuing through 2003 :

- Introduction of pre-job briefings prior to sensitive activities ;
- Creation of a project group assigned the task of improving the quality of risk assessments and work packages ;
- Work on the detection of precursors.
- Benchmarking

For pre-job briefings, the following principles were adopted :

For any activity having generated experience feedback (significant operating event, incident, near-miss), the basic work-team supervisor raises worker awareness by giving a briefing at the workshop. Pre-job briefings take place between the work team leader and workers at the job site. They stimulate the team’s questioning attitude towards immediate risks associated with the job. Pre-job briefings comprise a discussion of expected results (described in the work package), risks (risks specified in the risk-assessment, risks discussed with the tagging officer and risks that the work team leader and his team become aware of around the job site), and experience feedback.

With regard to risk assessment, the “ARDI” project group was set up in January 2003. It is the result of an in-depth investigation into plant ownership of risk assessments and more generally, into the relevance of work package content as a tool designed to promote questioning attitudes.

The project group includes representatives of all those involved in the drafting of work packages and consequently, of risk assessments. Contractor representatives have also been included in the project group.

Part of the management meeting held on 13 March 2003 was devoted to discussions between the corporate representative and risk-assessment users (EDF and contractors) on areas for improvement in this regard.

ARDI proposals taken on board by plant management at the CSN committee meeting of June 17th entailed the following: extension of risk assessment to all areas of risk and all activities; enhancement of the risk-assessment tool, simplification of work package documents by proposing a standardised risk assessment using an A4 document giving a summary of the work package and associated risks, proposals to improve the risk-assessment drafting process.

In brief, the plant has put a great deal of effort into this safety management tool (risk assessment) in order to make it a useful process for workers.

Lastly, actions to improve the reporting of precursors (see suggestion 5.3(2), TS) have also provided (and will continue to provide) an opportunity to work on the questioning attitude of all plant staff. Indeed, the plant has decided to enable all workers to report, using a common tool, anything that comes to their attention (anomaly still known as a ‘precursor’) and which they regard as being abnormal, in all areas where standards have been set (operational safety, industrial safety, radiation protection, environment.). This tool will contribute to the enhancement of pre-job-briefing feedback.

In order to develop a questioning attitude in the Plant and search for good practices, Tricastin implemented in 2002 and 2003 a benchmarking policy extended to the whole plant, in different forms:

- concerning the thematic working groups : the group co-ordinator identified other plants which had done the most work on the subject and organised exchanges (example: liquid waste, line-ups, monitoring in the control room, rounds...)
- concerning departments: depending on the subjects needing improvements, the management organized experience sharing within EDF (other Plants or EDF units) or with other companies such as Arcelor, Comurhex, Cogéma, Tihange, Dukovani
- At the plant management and co-ordination level, exchanges with other NPPs (Cattenom, Chinon) and EDF distribution (DEGS of Nice and Avignon)
- Concerning audits and assessments: thematic cross-assessments on nuclear safety (safety quality assessments by safety engineers), and radiation protection were carried out with Cruas.

In 2003 the momentum created on the Plant when preparing for the Osart in 2001 was continued: this momentum resulted in the real desire observed within the NPP departments to improve and implement greater thoroughness. It has also resulted in generally satisfactory results although some of them do not reach what we had hoped.

All during this year, following the advice of the Safety Quality Advisory Unit (MSQ), which can stand back from the issue, the senior management team examined the managerial actions to be taken to try to bring down trend in the growth rate of significant events:

- At the beginning of the year, a human factor analysis was carried out in the MCE department following a line-up error, which given the number of line-up significant events for the Plant (0.5/unit) has proved effective

- During the spring, after the IN inspection, the ART (coaching thoroughness in the field) approach was introduced, aimed at helping people in charge (managers and senior foremen) whose role is to be in the field, to no longer shut their eyes to basic deficiencies such as personal protective equipment, industrial safety, fire risk.
- This summer, priority was reaffirmed for the pre-job briefing with the objective of avoiding recurrences of events of the past, based on the 3rd R of the RRR (Results, Risks and OEF = REX in French) methodology
- All the operating managers agreed on a consistent managerial treatment of lack of quality, to accelerate the improvement of individual behavior.

It became apparent to everyone that it was essential to keep the whole management system consistent. It is only with time that these actions will bring results.

The Head of DSNR Rhône Alpes was asked in October about the 35 significant events and he confirmed that he still had a positive view of the management of nuclear safety in Tricastin.

IAEA comments:

The plant has during 2002 continued to work on initiatives for improving the questioning attitude and thoroughness by further developing self-assessment and internal assessment programmes, intensifying efforts in operational communication and inclusion of thoroughness in annual appraisal interviews.

During 2003 further development has been done of indicator programmes, self-assessment, pre-job briefings, extensive benchmarking and risk management, only to mention some activities. Cornerstones in the success, that now can be seen, are the extensive involvement of staff, the use of cross-functional working groups, extensive benchmarking and the strong involvement of management in ongoing improvement. The management's coaching in thoroughness in the field as well as the recognized and simplified set of reference standards are important contributors to the improving results. Also the now more frequent evaluation of indicators raises the awareness of the need of new to anticipate new actions or the strengthening of existing actions. The team agrees with the plant; the initiatives start to give fruits and the team insists on the importance of continuously monitor the improvements. Continuous monitoring of initiatives introduced is essential to sustain the results reached and maintain a continuous improvement approach.

Conclusion: Satisfactory progress to date

1.2(a) Good practice: Management initiative to improve plant performance.

The OSART review team noted that Tricastin NPP has achieved rapid and broad improvement in a number of areas over the last few years. The management tools used to achieve these results collectively are an effective means to achieve rapid improvement.

Strong leadership and control of safety related activities coupled with a sense of management planning is communicated professionally and consistently by the management team.

The programmes that make up this good practice are:

- a) The forward thinking management lead strategy formulated approximately 2 years ago has been supported by an effective integrated information system which

links all the key business objectives such as, business plans, action tracking, training, documentation updates, performance indicators which are accessible to all users.

b) The anticipated loss of competencies over the next 10 to 12 years has been recognized as a major future issue and the replenishment programme is ongoing. Both corporate and plant management are fully supporting this programme.

c) It was recognized that the interface between human resources department, training department management teams and specific training representatives within each department has become a means of improvement at Tricastin NPP.

d) Operation department training is supported by committed management involvement, such as attending and evaluating of training in classroom and on the simulator including the observations and operator assessments.

e) Managers and supervisors are also involved in the design of new training courses within operation department.

f) In order to unite staff across all departments, Operations developed a document entitled ‘Operations Nuclear safety requirement’. All departments shared in these straightforward requirements to improve the performance of the plant in terms of nuclear safety, industrial safety and radiological protection and availability. The document aids other departments to understand what is essential to safe and reliable operations.

g) A contractor monitoring programme has been implemented that directly contributes to the improvement of safety practices at the job site. The review team recognizes the deployment of the ‘Industrial safety challenge’ supported by management inspections in the field, as an important mechanism to stimulate improvements in this area.

h) Tricastin NPP is the first plant in the EDF fleet to implement the status-oriented approach in the emergency planning area. The staff took a leading role to develop and to implement the procedures in co-operation with the Bugey training center. Some of the improvements included, procedures to improve on site protection of staff and the issuing of potassium iodine tablets. Improvements in information transfer and communication between the ‘Poste de Commandement (PC)’ have improved exercise performance.

i) Significant improvements in procedures, supply and use of equipment, training regimes plus a substantial increase in the number of on-site formal emergency exercises per year, have raised the standards of emergency preparedness markedly.

j) The development of the Human Factors Network provides for training one or two human factors evaluators in each plant group. These people will lead the human factors development within their group, they will ensure that the needs of their group are represented in the development of the human factors programme, and they will report and analyze human factors issues.

These programmes support the achievement of overall improvements towards higher standards and encourage the plant to continue to move forward with the same determination as has been demonstrated over the past 2 years.

1.5. INDUSTRIAL SAFETY PROGRAMME

1.5(1) Issue: Industrial Safety policies are not always being adhered to by workers in the field. Managers and supervisors in the field need to increase the rigorous enforcement of the policies to improve the acceptance of international industrial safety practices.

- Several persons, are seen every day without a hard hat.
- 20 to 30 persons are seen daily without hearing protection.
- Although noise level zone diagrams are posted in the machine room (Turbine Hall), the practice of having two different hearing protection levels within what essentially remains a very noisy area, gives conflicting messages to staff about the acceptability of noise in the work place.
- Staff working adjacent to excessive noise, but not in the same work party, do not question the need to wear ear protection, e.g.; on a visit to the heavy mechanical workshop, loud & continuous noise came from building work machinery in an adjacent open plan room. The builders wore ear protection but EDF staff, only 2 meters away, didn't.
- RP subcontractor at entry to unit 3 not wearing gloves, other workers did not take corrective action.
- Smoking inside of buildings (numerous cigarette butts found inside buildings). Although the practice is to be able to smoke in the control room and tagging room, the tagging room does contain 6 months of official records. At present there is no general, across the site, formal policy for smoking.
- Car parked inside the turbine hall.
- Contractor drilling holes in the turbine hall floor without eye protection.
- Central chemistry laboratory fume hoods are not tested to check for adequate airflow.
- Poor lighting in pump room 3EAS-001-PO.
- In the area for storage of chemicals associated with Unit 1 and 2 laboratory, chemical protective aprons or shield, were not available, even though the area contained glass carboys of 96% concentrated sulphuric acid. The area did not have eye washers or emergency showers. The nearest water was approx 30 meters away via a complicated route.
- Oily waste stored in an unlabeled barrel adjacent to GFR pump unit on unit 3.
- In area of unit 3 steam generator a scaffold was being dismantled with urgency, there was no safe working area below the 10-meter scaffold.
- Lack of clarity and implementation of the smoking policy.
- Acid on floor adjacent to emergency batteries 4LBC001 BT & 4LCA001 BT.

Whilst improvements in the plants industrial safety record have progressed over the last 12 months, it is unlikely that this will be maintained, unless industrial safety attitudes and practices across the site continue to improve.

Without rigorous enforcement standards for industrial safety work practices, industrial accidents and plant equipment damage could result.

Recommendation: The plant should ensure that its industrial safety policies are clear and rigorously applied and complied with by all staff throughout the site.

The review and subsequent actions should be seen as management led and rigorously enforced by all levels of supervision throughout the site, including contractors, to ensure that the actions of workers in the field, lead to a continuous improvement in industrial safety across the whole site.

Plant Response:

In terms of ‘personal safety’, this recommendation illustrates a broader recommendation concerning the lack of thoroughness in the definition of and adherence to our reference standards.

It has therefore been addressed in a fully integrated manner using the same approach: clear reference standards which are common and familiar to all staff; improved monitoring and co-ordination of industrial safety actions.

PERSONAL PROTECTIVE EQUIPMENT

Standards governing the use of personal protective equipment have been made clear. Safe passageways have been routed through the turbine building and indicated by the appropriate visual markings.

Posted information on the use of personal protective equipment in plant areas has been extended and clarified.

Information campaigns and specific briefings have been carried out :

- A leaflet on ‘NOISE’ has been produced in conjunction with plant doctors. It was handed out together with hearing protection on the first day of the unit 3 outage. This will continue to be done when workers arrive at contractor reception;
- Industrial safety expectations are presented at industrial safety meetings periodically held within the departments, with the support of the SRM department;
- During outage periods, the SRM department chairs a weekly meeting focusing on industrial safety and radiation protection issues. Minutes of these meetings are posted in outage building C and at RCA entrances;
- Information campaigns rely on the site video network, industrial safety bulletin boards (topical campaigns) and the SRM newsletter ‘Objectif protection’.

WHERE CONTRACTORS ARE CONCERNED :

- Industrial safety information is given at kick-off meetings, prerequisite-action meetings and jobsite inspections, as part of the risk-prevention programme.
- Meetings between the plant and contractor companies are held in order to exchange views on contractor industrial safety results, action plans set up, plant expectations and areas for improvement.
- Prior to outage, the plant holds industrial safety meetings in order to brief part-time staff and new workers.

MONITORING ACTIONS AND COACHING IN THE FIELD HAVE ALSO BEEN REINFORCED

- An industrial safety challenge, set in place for outages and then extended to in-cycle periods, is an effective means of rewarding those workers who are most compliant with industrial safety rules.
- In addition to industrial safety and radiation protection, the grading chart used for the industrial safety challenge also covers fire protection and the environment. A statistical analysis of the results is used to pinpoint weaknesses through trend analysis and to target actions for raising staff awareness.

- Industrial safety management inspections (VHS) conducted by department management provide the opportunity to check staff knowledge and their implementation of reference standards.
- A weekly plant inspection carried out by on-call management is an effective means of monitoring plant condition and improvements in behaviour with regard to industrial safety in the field.
- Increased presence in the field was instituted in June 2003. Field inspections were held twice a day (during outage) as part of the “Coaching Thoroughness in the Field” initiative. These inspections are designed to train staff in the detection of behavioural deficiencies in the field, to correct these deficiencies and to track findings. The plant has focused its actions on the following areas: fire protection (fire load, adherence to no-smoking rules), use of personal protective equipment (hard hat, hearing protection, gloves in RCA), housekeeping around jobsites and respect for plant installations.

PLANT SMOKING POLICY

A number of working groups have reviewed the introduction of a single set of reference standards on the plant with regard to no-smoking policy and the proposed designation of smoking areas (EVIN law).

Clear standards have been established for the turbine building and diesel generator buildings (setting up areas or shelters with installation of ventilation equipment if necessary) as well as for the control rooms, tagging areas and the mechanical workshops.

This review is still underway for the administrative buildings.

USE OF HAZARDOUS SUBSTANCES

Industrial safety issues associated with the use of hazardous substances were addressed in detail through extensive actions designed to resolve the Fyrquel problem (recommendation 1.5 (2)) on the plant, and more generally as part of preparations for ISO-14001 certification. The MCE department applied itself to upgrading rooms and equipment which did not comply with standards or which exhibited maintenance defects, and emphasised the importance of supporting the industrial safety initiative within the department.

The memorandum on the use of chemicals, describing the rules governing procurement, storage, transportation and use of hazardous substances has been completely revised.

Measures have been taken to minimise risks associated with the handling of chemicals (purchase of acids and bases in unbreakable containers, equipment to facilitate discharging, purchase of personal protective equipment). Problems were examined and solutions were implemented in the form of working groups to get people more involved in their resolution.

INDUSTRIAL SAFETY RESULTS ARE IMPROVING

The lost-time accident rate (EDF + contractors) dropped from 13.34 in 2000 to 9.8 in 2001 and 8.4 in 2002. At the end of August 2003, the accident rate stood at 3.6 against a target of 6, with only 5 lost-time accidents at that time of year (instead of 18 for the previous year at the same period). This result places the Tricastin Plant in the first quartile of EDF plants.

FUTURE WAY OF IMPROVEMENT

A key feature decided by plant senior management for the 2004-2006 medium term business plan is to develop a project to get an ISO 18000 certification in the field of industrial safety. Like the improvement achieved for environment with ISO 14001 certification challenge, this goal could lead the plant to on-going progress in the industrial safety field.

IAEA comments:

The plant has in an appropriate way defined the root causes and implemented actions in clarifying the standards, improving the industrial safety posting, increasing management involvement and continuously raising the awareness of industrial safety hazards that is now showing improving results in lowering the accident rate. The trend must be kept under observation and staff's compliance with the standards regularly checked in the field by management and supervisory staff to get this issue to be closer to a resolution. Still some evidence was found that the smoking policy was not adhered to in some industrial areas, a scaffolding was built in the "free" pass ways in turbine building unit 2 and some signs on electrical cabinets were not up to plant reference standards. However in general, the team was very impressed by the improvements made since the OSART mission.

Conclusion: Satisfactory progress to date

1.5(2) Issue: The plant does not have a consistent approach in the arrangements and management associated with the handling of Fyrquel fluid.

The team observed that several actions had been taken to improve the material condition in the area of the Fyrquel tanks, filters and pumps on all four units, however the following observations were made:

- Barriers have been placed around several valves with a temporary paper sign posted to indicate that there were Fyrquel leaks present. For example, valve 2GPV024VV. Under the valves several absorbent pads covered the floor.
- The plant has undergone two shutdowns as a result of Fyrquel leaks on a flexible hose and a servomotor.
- The plant has a high annual usage of Fyrquel fluid on each unit, indicating leakage on the system.
- A technical problem with a regulating valve on all the pump units has existed for at least 10 years, causing Fyrquel to leak from the system, in spite of a modification to eradicate the problem.
- Unit 3 – In the Fyrquel instrument cabinet the labels on the sample bottles were not adequately attached. Fyrquel oil was seen on the lower part of the cabinet and unauthorized operator aids were taped to the inside of the cabinet door.
- Unit 4 – The Fyrquel instrument cabinet contained several oily pad locks and an oil soaked procedure for a surveillance test.
- All four units had dirty warning signs stating “Attention Fyrquel”. This does not properly support the important safety message that Fyrquel is a hazardous substance and that failing to take the correct precautions, could lead to personal injury.
- The area around 2GPV 024 VV pumping unit had a temporary poster giving advice such as:
 - “Do not expose the product to over 50 °C”.
 - “Protective glasses to be worn when handling this product.
 - This was not the same advice posted at the pumping units for each of the units 1, 2, 3 and 4, which was: “Attention Toxique”.
 - 1 If accidentally contacted with skin, wash with plenty of water, and if necessary take a shower.
 - 2 Do not touch food before washing hands.
 - 3 If contacted with eyes, wash the eyes with clean water for at least 15 minutes.
 - 4 Go to the medical center if ingested or in contact with eyes.

This is not consistent with the instructions in the material hazard data sheet “Fiche de Données de Sécurité”, provided by the manufacture which covers comprehensive advice and instructions for inhalation, ingestion, contact with the skin and eyes, measures to be taken in event of a spillage, handling and storage, and control of exposure/individual protection.

Fyrquel is a toxic and hazardous material which must be handled with adequate safety precautions and controls. Fyrquel not only has the immediate risks associated with eyes, skin and ingestion, there are also long term health issues which need to be understood and respected.

Without protective measures and adequate precautions for the use of Fyrquel, serious personnel injury could result.

Recommendation: The plant should review and resolve their current technical, procedural and communication issues for handling Fyrquel.

Plant Response:

To begin with, the plant set up an enquiry in order to identify the root causes leading to the Fyrquel recommendation. This enquiry pinpointed three specific points associated with the Fyrquel issue at Tricastin NPP.

- Technical design of equipment and associated maintenance;
- Absence of clear and consistently-shared reference standards;
- A lack of management over the whole Fyrquel issue.

The aptness of this recommendation was confirmed in the months following the OSART mission by two incidents on units 1 and 4, which occurred on pipe-work of servo-motors on HP cylinder pressure-relief valves.

On the basis of this assessment, four areas were identified in order to make site-wide progress on the issue:

- Management: Co-ordinate the whole issue in such a way as to perpetuate results and good practices ;
- Reference standards: Define and take stock of expectations ;
- Communication and raising of awareness: Make standards known to staff ;
- Maintenance: Bring installations into line with standards.

Actions included in the plan to deal with the Fyrquel issue address the areas of industrial safety, the environment, availability, material condition and cost control.

MANAGEMENT

Plant senior management has decided to:

- Set up a comprehensive oversight structure in the form of a ‘Fyrquel site project’, regularly monitored at Operations Technical Meetings (RTE), with an appointed co-ordinator and allocated financial and human resources.
- Address the Fyrquel issue within a broader scope encompassing the proper use of hazardous substances, an issue being dealt with to obtain ISO 14001 certification.
- Set up an efficient fast-track experience feedback system for Fyrquel occurrences, with feedback monitored at RTE meetings and widely conveyed to operations and maintenance staff. As an example, an analysis of the Fyrquel leak on unit 4 was requested by the Associate Director for Power Operations.
- Gauge results and perpetuate good practices by monitoring the condition of equipment using Fyrquel and the associated amounts consumed, and by checking whether risks and expectations have been taken on board in the field.
- For all outages scheduled for 2003, the plant has appointed an assistant to the Outage Manager, entrusted with the task of itemising and monitoring the correction of job-site deficiencies giving rise to OSART recommendations, including the Fyrquel issue.

REFERENCE STANDARDS

With regard to the drafting of clear reference standards for Fyrquel-related hazards, the plant has implemented the following actions :

- 1 Drafting of a cross-functional document (“The ability to respond in emergencies”), which stipulates what to do when transporting, transferring or handling hazardous substances, including Fyrquel, on the site.
- 2 Extended use of Local User Sheets, which are made available in storage areas, as well as Environment Action Sheets, placed close to areas where Fyrquel is present. These sheets specify the risks associated with any chemical substance.
- 3 Drafting of a technical memorandum for the monitoring of small Fyrquel leaks during power operations, in order to identify corrective actions to be implemented during the following outage period.
- 4 The industrial safety booklet also contains a sheet describing the Fyrquel hazard in detail. This booklet is given to contractors during their plant access formalities.
- 5 A preventive action, carried out during the planning phase of an activity, the aim of which is to check that industrial safety and environmental risks associated with Fyrquel are taken on board. It appears in various documents used on the plant, depending on the type of job and significance of the risk identified: risk assessment, prevention plans, work procedures, monitoring plan. Fyrquel-related hazards are reiterated during kick-off and prerequisite action meetings.

COMMUNICATION, INFORMATION, RAISING OF AWARENESS

With regard to coaching and raising staff awareness about the risks and expectations associated with Fyrquel, the plant has implemented the following actions :

Industrial safety information:

- Instructions to be followed after spraying or ingesting Fyrquel have been visually displayed using clear signs. This has also been presented to plant staff and contractors working in the presence of Fyrquel during training and briefing sessions.
- Expectations regarding the handling and storage of chemicals are posted in the field.

RAISING AWARENESS WITH REGARD TO THE FYRQUEL ISSUE

This initiative was aimed at maintenance workers and operations shift crews as well as other plants and members of the corporate engineering structure.

- The Fyrquel issue was discussed at three introductory forums held for the benefit of contractors during the 2003 outage cycle (43 companies involved).
- An information leaflet on Fyrquel has been drafted in conjunction with the DPN and the Occupational Health and Medical Service. It has been handed out to plant staff and contractors working on circuits where Fyrquel is present. It has been made available to all EDF plants.
- For contractors not required to work on Fyrquel circuits, the Fyrquel sheet included in the industrial safety booklet reminds them of hazards and associated protective measures.
- Operations shift crews participated in an experience feedback and information session based on feedback from the Fyrquel event on unit 4 in July 2002.
- The contractor supervisors’ training curriculum for the 2003 outage cycle includes a training module on environmental requirements, including the Fyrquel hazard.

- During management meetings, the project manager periodically reports on the progress being made with OSART recommendations, including the recommendation on the Fyrquel issue.
- Lastly, all plants and members of corporate engineering support have been informed of the incidents and their consequences. Checks have been scheduled for future outages and the issue will be discussed at the annual turbine experience feedback meeting. All results of corrective actions, which could be regarded as good practices due to their effectiveness, will be conveyed to other plants.

MAINTENANCE

With regard to the condition of equipment on which Fyrquel is used, the plant has implemented the following actions :

Refurbishment of the plant and improvement of practices :

- Cleaning, diagnosis and minor maintenance tasks during outages in 2002 and 2003.
- Analysis of plant modifications designed to limit the release of Fyrquel spray (plugs, breather vents).
- Installation of retaining devices to channel any persistent leaks that cannot be dealt with during plant operations.
- Optimisation of filter replacement schedule and method - GFR 300 and 301 FI. (Replacement now every 12 months instead of every 3 months, in accordance with basic maintenance programme).
- Equipment procurement : Mobile retaining devices for shipment, retaining devices for drums used to contain solid Fyrquel waste. In particular, areas with a Fyrquel risk are equipped with anti-pollution kits.
- Involvement of field operators in the identification of minor Fyrquel leaks.
- A leak-detection and monitoring campaign is being conducted during the operating cycle in order to compile a work package that will be acted upon during the following outage.
- Ongoing efforts to maintain plant condition : If all actions scheduled for 2003 do not yield satisfactory results, the Technical Advisory Group will submit a proposal to the RTE committee, suggesting that larger modifications be carried out. In future, GFR tanks will be scheduled for repainting during outage after major maintenance operations. The GFR tank on unit 2 was repainted as part of this effort in 2003.

In-depth analysis and initial processing of servo-motor pipe-work incidents occurring in 2002

In 2002, two cracks on high-pressure pipe-work on GFR valves were the cause of Fyrquel leaks in the turbine building. During the incident on unit 1, a check carried out on the unit's other valves revealed the beginnings of a crack on a third piece of identical pipe-work. These cracks are due to vibration fatigue around the weld. There may be a number of aggravating factors: quality of the weld, static stress from the outset or caused by assembly and dismantling. These incidents are the only ones of their kind to have been recorded at any French plant to date. An action plan has been drafted and approved by the RTE committee. It has two objectives :

First short-term objective : Eliminate this type of incident on these servo-motors by introducing checks and carrying out maintenance on intake valves during the 2003 outage campaign.

Second medium-term objective : Guarantee lasting reliability of servo-motors at this plant and other French plants. For this purpose, a vibration test on the servo-motors was conducted by the EDF R&D Vibration Testing Group in order to confirm the diagnosis of vibration fatigue and investigate possible solutions. Findings will be written up in a technical report, which will be submitted to the GMSA co-ordinator and other plants at the turbine committee meeting in 2003, in order to define plant-specific and corporate strategies.

The plant has also approached the turbine vendor to obtain their position on the replacement of sensitive pipes by flexible pipes. The vendor is not in favour of this alternative. However, they encourage the NPP to opt for servo-motor investigation, since these components could cause additional vibrations.

Based on R&D conclusions, solutions for limiting stress have been established by installing additional support devices. Tests were satisfactorily carried out on Unit 3 where the stress level was reduced by 66%. The installation of such support devices will be extended to all 4 units.

Finally, the corporate engineering network has set up a work group to look at the replacement of Fyrquel by an oil which is less hazardous for people and the environment.

IAEA comments:

The Tricastin plant is the leading (Pilot) plant in EDF to develop the new approach to handling and use of Fyrquel, impressive improvements have been made since the OSART by development of new reference standards and to attack the concerns with the use of Fyrquel and associated technical problems. A special leaflet has been developed, with support of medical staff at Tricastin, that covers the concerns with Fyrquel, which is now shared with all other plants in the EDF nuclear fleet. Solutions to the technical problems have been developed and are now also shared with the other plants. A long-term action plan is under development, which includes a search after less hazardous high temperature hydraulic oil. The approach of Tricastin plant to resolve this issue is exemplary.

Conclusion: Issue resolved

2. TRAINING AND QUALIFICATIONS

2.1. ORGANIZATION AND FUNCTIONS

The Human Resources Advisory Group is a major contributor to overall function of support for training design and oversight. The human resources plant advisor (Chef de Mission), is responsible for the definition of policy, strategic co-ordination, development of proposals and overall monitoring of performance, working closely with the training providers and the heads of departments. The specialists within the department are available to maintain an overall “big picture” focus for training needs at Tricastin NPP.

An action plan was established based on feedback in 2000 from the regulator and internal audits and assessments requesting improvement in the overall training function at Tricastin NPP. The action plan, responses to tracked items, status of responses and improved functions are monitored by human resources but only closed following review by the on site QA Advisory Group for Safety and Quality. The action plan has proven to be effective and is in the process of continuous improvement. A review of the actions was performed and verified as complete or in progress during this mission.

The operational responsibility for the implementation of this policy is performed by the manager of the human resources advisory group and implemented by his specialist. This specialist has the overall responsibility to work with the other departments within the plant and training to ensure task analyses, work files and training skills are implemented in an effective manner.

Within the specific departments of the NPP, training representatives maintain the training programmes and ensure skill sets are tracked and maintained for the department manager. These training representatives interface routinely with the human resources specialist who functions as an on site consultant. The training representatives are responsible for keeping and updating the individual training records for all training matters. These training representatives are responsible for maintaining the official records and files for each employee. A computerized system of attendance is maintained within the site training department and is utilized by the training representative to maintain attendance. One suggestion was made to encourage the human resource specialist to revise the policy covering attendance to delineate the official record and when the computerized system should be used for updates.

The training representatives who meet routinely as a group work within the departments to determine training course requirements for the year and send notices to the training department notifying them of the future attendance of their staff at site and corporate courses. Although the training department provided effectively maintains a daily update of attendance, the official ownership of the training programme is with each department within the plant. During the mission excellent interface between the human resources department, the training representatives within the plant departments and the training department was observed. NPP senior management provides training coordination. The operational departments perform needs analysis, shadow training and grant authorizations for nuclear safety work. The site training centre, operations training centre, professional training services (corporate SFP), part time trainers and external organizations provide design implementation and course management.

Tricastin NPP does not presently have a simulator, therefore the training is performed at the Bugey national training centre, sixty (60%) per cent of the training is carried out on site. In 2004 a site specific simulator should be completed at the Tricastin NPP site which will increase the amount of site training.

Job task descriptions have been developed for each job on site and are maintained with training files and the individual training programme which is performed annually during performance reviews for each employee. These skills criteria are then used in assessment guides for nuclear safety authorization. The nuclear safety authorization process is based on skills that are referenced for each function and based on the task analysis and objectives. This ownership of nuclear safety authorization is very positive.

Many methods of training are utilized at the plant for assurance of maintaining qualification other than the classroom and simulator. To ensure skill levels are maintained, the manager and training representative administer this process through each department. These include; tutoring, shadow training, cross functional training, situational team training, coaching and individual project development. These are all supported and implemented by management staff. This use of multi faceted training is conducive to promoting effective training.

This strategy has been implemented within all departments on site. Part time trainers also provide three hundred and eighty (380) man-days of training for the training centre. This group is organized, trained and scheduled along with the permanent training staff. Seventy-six part time trainers are in the programme. The part time trainers club was recognized by the team as a good practice. The instructors provide a bridge for support, feedback and interface with their departments and reinforce the strong support and ownership of plant management to training.

A programme of shadow training is also implemented within the training structure. It is based on a signed agreement between the manager, an assigned tutor and the trainee. At the present time there are one hundred and twenty eight (128) trained tutors on site. The agreement contains the training plan for the necessary qualifications needed for the assigned function. Evaluation is performed routinely and an assessment of status and improvement maintained every two years or at performance appraisal intervals.

It should be noted that a yearly training plan is designed and maintained within each department. Every department has a standard training plan (PTF) developed for each function that consists of courses identified by the department manager as a part of the employee improvement plan. The individual training plan (PIF) is then compiled after an individual appraisal and training interview between the person and their immediate supervisor. The training files and tracking methods for the employees are well structured and implemented and appear to be uniform across the departments. Future plans are to better define each plan and ensure thorough consistency.

2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

Each training site reviewed and evaluated was well prepared and maintained to provide effective training. The training material is well developed and based on identified tasks, objectives and lesson plans. The classrooms are all well equipped and are supplied with the necessary training tools. The simulator facilities at Bugey are well equipped and the simulator fidelity appears to be very good. Material for training and the training `enter` at the site and Bugey are very good. The simulator scheduled for delivery in 2004 will provide and encourage even more effective training. Mock ups are also available in many of the classrooms for Field Operators, Maintenance and I&C and other functions. Maintenance training is also provided at a national training center near Paris at Gurcy.

In addition, the site has a SIPACT simulator used to visualize physics phenomena which is also used for key personnel in the EPP and SEPIA simulator is especially used for steam generator tube rupture.

There is a designated area and programme for fire fighting training.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

Initial operator training is conducted at the site level and Bugey nuclear training centre. Refresher training is also conducted on site, at the Bugey 900 MW simulator and by using SEPIA and SIPACT on site.

The operations crews receive two weeks of full scope simulator training per year, one course concentrating on technical aspects and the other on team situational training focusing on soft skills. The technical refresher training is composed of topics selected at corporate level (40%), site level (40%) and from crew requests (20%).

A monitoring system is set up to keep track of identified skills used in the field. The site simulator input in the simulator programme is based on this system. Additional training on the site simulators SEPIA and SIPACT rectifies any areas identified by the annual training feedback report.

The management at Tricastin in the operations department regularly attend and observe the training at the site and at Bugey national training centre. The observations are used for assessment of the training programme and the comments are provided as feedback and input into the future training. This attendance and programme feedback provides a good example of management support of training.

The Operations training department works closely with operations and human resources and have formulated and implemented an effective programme for evaluating shift managers and operations managers prior to appointment .

2.4 FIELD OPERATORS

Field operator training was reviewed from task analysis through final programme development. A CIF, individual training file, is maintained for each employee and contains training completed and planned and includes safety and technical authorization certificates. An exercise was observed that was coordinated between the on site SIPACT, classroom and plant, where tags were placed to simulate a steam leak. This was found to be effective. The Operations training site manager ensures the programmes and services are provided as necessary to the plant. The Field operations training was found to be generally effective in meeting the operations department needs. However, the operations section of this report contains a recommendation on field operator rounds. Interviews were held with Field operators and other staff to request feedback on training and their programme evaluations. All were positive and the interviewees indicated they were comfortable with the mechanism of providing feedback to the training department.

2.5. MAINTENANCE PERSONNEL

Eighty per cent (80%) of the Tricastin NPP maintenance training is provided at the site and at the Gurcy training centre. Maintenance personnel training which includes the I&C functions as well as mechanical and maintenance, is skills based and includes an established task analysis and is structured as with the other training.

The training center supports the training process with scheduling, classroom support, some mock-ups and instructors. As with other departments the PTF is developed and reviewed by the employee with his manager. All programmes and records are maintained within the

specific departments by a training representative and owned by the Department head. The training files include the yearly plan, completed training, nuclear safety work classifications and the yearly plan that had been established by the employee and his manager. The CIF not only ensures a well documented training plan but also confirms the level of safety authorization (nuclear safety level of plant systems work) for the employee. Future training is then scheduled with the site training department. The system of defining training objectives derived from the task analysis and based on competencies and skills is complete for the maintenance and I&C departments. This programme effectively ties into the PTF and the forms are available in the employee files. New recruits are covered by the same process and assigned a shadow trainer who provides a thorough experience transfer from the experienced trainer to the trainee and allows for continuous progress reviews.

Contractors are closely monitored by an assigned controller who works with an individual assigned from industrial relations to monitor and evaluate effectiveness and implementation of contracts requirements. Audits are performed on the contracted company and feedback from the plant and department determines their continued work.

Refresher training is also monitored and maintained in the same manner within the maintenance and I&C departments.

2.6. TECHNICAL SUPPORT PERSONNEL

Safety engineer training is based on competencies and skills and coordinated in the same manner as the other departments. It is effective and provides the necessary skills development to ensure that oversight is a useful service to the plant.

Shadow training is utilized and a PTF developed for each employee which provides tracking for safety authorization as with the other departments.

Other technical programmes such as Radiation Protection, Nuclear Engineering and Chemistry are developed with the same task and skills base. Objectives are determined and training provided, monitored and assigned within policy and procedural commitments. These programmes appear to be in line with the action plan that has been developed and coordinated with human resources as a part of the overall improvement process in training and the plant.

2.7 MANAGEMENT PERSONNEL

Management programme training includes skills based on feedback from personnel appraisals and management issues derived from corporate task analysis and is provided by internal and external experts. Training and programme development was reviewed at different levels. The programme may last several months but is not developed for one time continuous training but over a longer period. As with other training functions, managers within EDF and Tricastin NPP as well as within the promotion line in operations are reviewed during the performance appraisal function for future training. Competencies are evaluated to ensure they are in agreement with the companies goals, objectives and policies. The operations competencies for shift supervisor and shift operations manager are, for example, developed focusing on management skills and strong review panels that challenge the candidate as he/she progresses through the organization. They provide a method that is part of a structured selection process. This review and training also focuses on identifying the appropriate attitude and safety perspective of the candidate. All management positions are reviewed against established expectations for the potential candidate and are based on assessed competencies. Another support function in choosing competent managers is an aggressive recruitment programme that

is well structured and focused on specific replacement for staff leaving or potentially leaving the NPP.

The programme focuses on general management skills, such as leadership, communications, project management and coaching. A CIF is also maintained for nuclear safety authorization tracking.

Human factors training was observed and reviewed. It is utilized as part of the process to incorporate the human factors programme into the plant reviews of events.

2.8. GENERAL EMPLOYEE TRAINING

General employee training is developed based on tasks and is of good quality and is provided as a refresher routinely every two (2) years. The initial training and refresher courses are in line with IAEA safety standards and based on good international practices.

Many staff participate in the training and the part time trainers are involved for specific tasks. The training includes quality assurance, radiation protection, fire fighting, industrial safety and regulations and guidelines. Although the training is well prepared some industrial safety practices are not implemented effectively and therefore a suggestion has been made to consider developing photos or a video to be used with management and plant staff that demonstrates expected plant conditions and expected management involvement.

For employees who have an emergency response role it was noted that refresher programmes are provided more routinely.

STATUS AT OSART FOLLOW-UP VISIT

The training section has made real efforts to resolve the two suggestions whilst also retaining the good practices identified in the OSART of 2002.

The response to issue 2.1(1) has been resolved by ensuring that the computerized training records data base contains the up to date training records for all staff, whilst retaining the confidence that the paper Authorisation Certificates, which are issued annually, will only occur, if the computerized training record verifies that each individual complies with the training requirement for the role.

The plant has also resolved the issue in 2.7(1). The new and excellent training material working in conjunction with visible manager support, through coaching in the field, has resulted in an improved performance in the field. The special video on reference standards was particularly good, as it practically demonstrated the reference standard observational techniques associated with improving housekeeping, industrial safety and radiological protection to be applied in the field. The video was produced at Tricastin with the active involvement of plant managers. The CD-ROM uses the same film with the added value of being interactive, such that assessment of individuals is both consistent and measurable.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.1(1) Issue: The system of recording training data does not provide specific guidance for tracking training attendance routinely versus annually.

Individual training files are stored within departments. The files contain information on codified corporate courses, site-codified courses, site non-codified courses, shadow training and individual qualifications. The information is contained in a computer system within the training department and on paper in each department. The computerized database system contains information on corporate and site-codified courses.

The training section and the training representatives of the departments are involved in updating this system. The updated printout is however not filed in the individual training record except to verify attendance of an employee. The training records in the department are considered the official records but are only updated as required in the procedure on an annual basis.

Examples: During discussions focused on the topic of attendance some records were made available for employees in the QA department and although the files were completed within the employee training plan and materials, the actual attendance at course is determined by the computerized database in the training department.

It was determined through discussions that all department records would be in the same state of incomplete data on attendance during the year and that each manager could check the computer records in training for verification and completion. This could possibly result in a training file not having up to date information.

Without specific guidance for tracking training attendance information, required training attendance could be missed.

Suggestion: Consideration should be given to review the system of recording training data to ensure that a comprehensive and consistent approach is maintained. The plant should consider which system is best suited to comprehensively track training attendance and proceduralize this system to ensure consistent tracking.

Plant Response:

Training-course attendance data is updated by administrators of the Training Advisory Section (HR department), who have sole authority to record them in the GESPRO application. Individual training files (CIF) are updated once a year during the training survey, by replacing the paper copy of the worker's individual training plan (PIF).

Following discussions with the Training Co-ordination Group, a detail concerning the reference standards was added to the organisational memorandum: "Only the updated computerized version of the PIF may serve as an official reference." This sentence has been added to appendix 1 regarding individual training files (CIF).

IAEA Comments:

A systematic approach has been deployed by the plant, firstly by nomination of the computerized training records system as the official reference and secondly by the clear linkage between the computerized system and the paper Authorization Certificates, used to ensure that staff are always "In-Ticket" for the role they carry out. The team suggests that the plant introduce a more user friendly computerized system such that individuals and supervisors may personally view the up to date training records of their staff. This may lead to an elimination for a paperwork system

interface. Updating of training records should still be carried out by specific authorized personnel.

Conclusion: Issue Resolved.

2.1(a) Good practice: Since 1992, Tricastin NPP has been implementing a programme of trainer support to the NPP identified as the “Club des Formateurs à Temps Partiel “or the Part Time Trainers Club. This group of individuals is specially chosen from volunteers, provides training for all the training departments at the site, which allows the trainers to share their plant technical knowledge and experience. This programme also provides a mechanism for strong operating experience feedback. There are currently seventy-six (76) part-time trainers in the club coming from all the departments within Tricastin NPP. They cover the fields of nuclear safety, first aid, environment, emergency plan, radiation protection, information systems and fire fighting. A “club “coordinator within the training ` enter manages the scheduling of the part time trainers, relations with the managers and training skills development. Although many personnel volunteer for the programme only those demonstrating the appropriate skills and attitudes are chosen. The part time trainers use their training skills to enhance their career development at Tricastin NPP as possible future managers and supervisors, future full time instructors, future experts and advisors. In the year of 2001 three hundred and eighty (380) man days of training was provided to the training departments at the plant. The programme is controlled, proceduralized, monitored and assessed on a routine basis to ensure the highest level of implementation. Each trainer has a personnel file maintained within the department and evaluations are performed. Plant management supports the programme and as mentioned above this provides many days of training for plant staff through the use of their staff. At the present time this programme is specifically implemented at Tricastin.

2.1(b) Good Practice: Since the Tricastin NPP has focused their attention on the improvement of training and established and implemented a monitored action plan, multiple methods are in use to ensure skills attached to tasks are met and maintained. During the review process it was noted that the maintenance of job functions are not based entirely on traditional type training courses. A specific policy implemented in Tricastin NPP is to offer a variety of methods to trainees to maintain their skills and competencies. The plant supports its new recruits with a formalised tutoring and shadow training programme based on trained tutors and shadow training booklets. Immersion programmes are proposed and implemented to improve cross-functional experience and skills. A project-based training method has been developed where there is theory input followed by the development of a project for each trainee to develop and implement based on course work completed. This project is then presented, discussed and assessed by the training centre and management. Situational team training is then used for practising action sheets for all field staff. The strength of this system lies in the fact that team management follows the field staff and completes observation sheets during the training. Afterwards well constructed debriefing sessions use methods of active trainee participation to prod and encourage response focused toward improvement. Newly appointed managers are provided with coaching to ensure they are able to perform the oversight function of this process. As a part of this programme the operational departments monitor infrequently performed and other unusual activities so that these skills are constantly maintained by task assignment rotation and by including the tasks into scenarios for simulator training. The networks set up for key functions such as human factor specialists, contractor monitoring supervisors and team leaders enable the participants to identify training needs, share their experience, brainstorm and solve problems.

2.7 MANAGEMENT PERSONNEL

2.7(1) Issue: Management involvement in the field does not motivate employees sufficiently to compel them to adhere to management expectations, policies and standards in their everyday work. During the walk downs and plant tours the team observed that in many cases, high industrial safety standards are not practiced in the plant. The team observed the following:

1. The refresher courses on industrial safety and radiation protection are of good quality. However, the team observed that in many areas of all four units plant staff did not comply with the training provided as a routine part of normal daily work.
2. There is a lack of rigor applied to the industrial safety standards such as wearing of hard hats, ear protection, smoking in restricted areas , closing of fire doors and management involvement when these issues are observed.
3. Management personnel are not aggressive in identifying and coaching staff when observations are made in the field of industrial safety non-compliances. (see issue 1.2(2) and 1.5(1)).
4. Performance standards and principles are not being consistently applied in the field for routine execution of work.

Although managers are present at the opening and during the evaluation of various training courses, and the training programmes appear to implement the necessary tasks and objectives to advocate expectations and set standards, performance does not meet the training provided.

Without a strong commitment to adhere to industrial safety and radiation protection rules, improvements in the field will not be reached.

Suggestion: The plant should consider that in addition to existing managerial measures for areas needing performance improvement such as industrial safety and radiation protection, all the managers should take an active part in reinforcing the expectations set by the plant manager. The team suggests that the plant consider developing and using site specific tools (pictures and videos of actual and ideal conditions at Tricastin NPP) to reinforce their commitment to helping their staff continue to improve adherence to plant expectations in these areas. These aids would reinforce management's need to intervene with employees when non-compliances are observed to coach and encourage adherence .

Plant Response/Action:

In response to the IAEA suggestion, three separate but complementary actions have been decided upon.

PRODUCTION OF A SPECIAL VIDEO on reference standards governing industrial safety, radiation protection, the environment and plant condition.

This film demonstrates good practices implemented on the plant as well as artificially staged deficiencies for training purposes.

The film is designed to foster a questioning attitude in workers, resulting in improved detection/correction of deficiencies, higher housekeeping standards, greater thoroughness during work activities (adherence to procedures, housekeeping around job-sites, foreign-material risks, etc.) and an improved response to expectations in the areas of industrial safety, radiation protection, the environment and plant condition.

The film comes with an accompanying document (list of deficiencies/reference standards with comments) and a training package. The film is aimed at an extremely varied audience: EDF maintenance workers or contractors, field operators (operations), supervisors, managers responsible for enforcing standards.

Its use is gradually being incorporated into various training activities, with the support of the plant's quick minor-maintenance team:

- It is included in training courses attended by contractor supervisors and contractors.
- It is included in routine Friday inspections.
- The corporate professional training department (SFP) is in the process of incorporating it into risk-prevention refresher training (compulsory every two years).

1 PHOTOS AND COMMENTS portraying actual situations observed by management during field inspections are regularly shown to all plant staff and contractors on the plant video network.

2 AN INTERACTIVE CD-ROM – taken from the film – is currently being produced. It will serve as a tool for ongoing personalised self-assessment on reference standards.

These training media (film, CD-ROM) will be brought to the attention of other plants for extended use on all French sites.

IAEA comments:

The special video on reference standards, which is already in use, is of good quality and designed to demonstrate practically, observational techniques to be applied within the plant areas on housekeeping and industrial safety. The special video is systematically used for refresher training of all EDF staff. The CD-ROM, which is currently under trial, uses the same film with the added value of being interactive, to ensure that the assessment of individuals is both consistent and measurable. However, the success of this excellent training material relies on rigorous coaching in the field by Managers and supervisors to achieve a measurable and continuous improvement.

Conclusion: In terms of training: Issue Resolved.

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTIONS

The operation department is managed and staffed by well-qualified engineers, professionals and technicians. In order to strengthen the attitudes of the staff and communicate their central role the operation department has developed the document “Operation Nuclear Safety Requirements” and conveyed the content to the other departments. The team has assessed this as performance improvement.

The operations department for all four units at Tricastin NPP has adequate staff. Seven shift-teams per twin-unit are responsible for real-time operation. Each shift team has 1 shift operation manager, 1 shift supervisor, 1 tagging supervisor, at least 4 control room operators and 5 field staff (field technicians and field operators). The shift schedule is designed so as not to have more than three night shifts in row, including training and vacation time.

The role of the off-shift organization structure is to support the on-shift structure in the areas of expert appraisal and operator experience feedback, coordination of short shut-downs, planning and coordination of refuelling outages, planning of medium-term activities and on-line technical support.

The off-shift organization is divided into three groups: Technical Support, Methods Branch and Training.

The cross-functional “Power Operations Project” is partly staffed by members of the Operations department, but also includes personnel from the Coordination department, the Safety and Quality Advisory Unit, Chemistry, Mechanical Maintenance, I and C and Electrical maintenance, Industrial Safety, Radiation Protection, Nuclear Logistics and the Modifications team. This team produces an effective daily graphical time plan which provides the control room with information on activities such as surveillance tests and other significant occurrences scheduled during the shift.

Another important cross-functional team is that of the “Outage Project”. This team is responsible for scheduling and planning outages on all units.

3.2 OPERATIONS FACILITIES AND OPERATOR AIDS

Each unit has a main control room and emergency shutdown panel. The unit 1 and 2 control rooms are adjacent, separated by a meeting room. The same layout exists for units 3 and 4. They are well equipped, well located and use displays which include mimics and annunciator alarm panels. Access is well controlled. However, the plant may consider developing the plant computer so that the unit’s key parameters can be displayed together and can be seen from all parts of the control room. The annunciators are equipped with diode lamps (LED’s) to avoid reflection of lights and difficulties when changing them. The number of active annunciators is low. Tricastin’s goal is zero annunciators lit. Tricastin NPP has implemented a programme to identify deficiencies and correct them. This is now underway and good results have been achieved on units 1 and 2. However greater efforts are required to bring units 3 and 4 up to or above the standard of units 1 and 2. In this regard, housekeeping in external areas is good and in the plant generally was acceptable. However there were some areas in units 3 and 4 and away from the normal tours area that should be maintained at a higher level of cleanliness. The team provided a recommendation in this area.

The team recognized need of improving plant labeling and recommended Tricastin NPP to strengthening their labeling programme.

Line-ups for work or for other reasons are well managed by the tagging supervisor with support from the shift-team and Power Operations Project. However information provided to the control room operators about locally operated equipment can be improved and the team has made a suggestion on this subject.

The nuclear safety time-plan (Diagramme Pédagogique Sécurité) is a very good idea. This safety plan is fixed 90 days prior to the start of outage. It has a well-designed layout. In addition to time-lines and reactor modes, it also displays reactor system level, main work activities, and the extent to which systems can be made unavailable.

3.3 OPERATING RULES AND PROCEDURES

The operating rules are generally presented in technical specifications for operation, incident and accident procedures, monitoring and surveillance test programmes for equipment and safety-related programmes. Main operation procedures are developed based on the technical specification limits. Surveillance programmes are documented and all information analysed by the operations department.

Operating procedures are in good condition, clearly written, well understood and provide the necessary references. The system for procedure updating works efficiently. There is a well-organized system developed for operators to report all operation procedure errors. In the event of any modification to operation, a temporary operating instruction is provided to take into account any deviation from the operation document. Flow sheets and emergency procedures are encased in plastic and carry coloured information.

Emergency procedures are symptom based. They are of a high standard, are clearly understood and are easily accessible. When a deviation occurs, an alarm gives operators reference to the right procedure. Operators can easily and quickly find the procedure.

The logistic branch performs procedure updating, and their main tasks are:

- Incorporate the corrections to operating documents (procedures, alarm response sheets and surveillance tests),
- Draw up and validate the fire action sheets,
- Prepare for the integration of modification files sent by other departments,
Two Shift Supervisors are at the head of this branch:
- One Shift Supervisor updates and supervises the operations department documentation,
- One Shift Supervisor supervises and analyses the documentation of the modifications to be integrated, either with the unit shut down or in operation.

They are assisted by staff seconded from the shift teams and by permanent staff.

It is very important for operators to report and for managers and authors to review procedures after data has been filled in, in order to correct deviations to support improvement of human factors and correctness in documents used for operation.

3.4 OPERATING HISTORY

The plant has implemented a long-term operations data and history programme for improving the safety and reliability and monitoring of the effectiveness of operations. The system contains the most important indicators, although in the technical support section of the report, the team issued a recommendation concerning the analysis of events associated with work site activities.

Operating experience feed back is sent to operations personnel on the shift and is part of the operation managers responsibilities. If necessary, lectures are used to transmit the most important operating experience. An electronic mail system is used for rapid experience feed-back (REX)

In the technical support section of the report, the team provided a suggestion about the threshold for reporting “low” level events. Reporting and analysing these low-level events is essential in identifying precursors that could be used to prevent events and improve training.

3.5 CONDUCT OF OPERATIONS

The control room gives the impression of professionalism. Operating procedures are available in the control room and are used.

Shift turnovers of control room personnel were observed to be detailed, professional and of high quality. The briefings following the turnovers are adequate to assure the information exchange within each shift crew is of high quality. During debriefing and shift turnovers the communication pertaining to the unavailability of safety related equipment is given priority.

Operations personal do not use three-way communication, STAR (Stop, Think, Act, Review) techniques or use of the phonetic alphabet when communicating or performing field actions. The team encourages that the plant review these practices.

The surveillance programme adequately verifies the availability of safety equipment.

Field operator rounds are supported by special portable computers which are good tools to record, compare and submit important plant parameters. However, the observed round was focused on the parameters required by the computer and was not attentive to material condition, industrial safety and fire protection deficiencies. The team recommends improvements in the observational skills of field operators and better coaching by supervisors and managers.

A successful cross-functional group is the Technical Effluent working group (GTE). The site has a very effective programme for minimizing liquid effluent releases and the team has recognized a good practice in this area.

3.6 WORK AUTHORIZATIONS

The plant system for work authorization is well organized. A person that detects a deficiency reports it using SYGMA, a corporate application designed for maintenance work management. Four daily cross-site meetings, with managers involved, give a broad understanding between departments of how work is prioritised. These meetings are:

- a) Diagnostic meeting.

The participants are the shift supervisor, two I & C and electrical technicians and one mechanic. This meeting is held every morning and the purpose of the meeting is to process the various work requests issued since the last working day so as to make a prompt diagnosis of the various defects identified and to rectify these if possible.

b) Daily meeting at 8 am.

The participants are the shift operations managers, the associate directors and the power operations project supervisor. The shift operations managers present an assessment of the units' status and any problems encountered.

c) Daily meeting at 11 am.

The participants are the members of the power operations project team, including safety engineers. The following subjects are dealt with:

- Examination of the various work requests issued by the operations department and validation of the ranking of priorities.
- Discussion of the other work requests considered as important.
- Assessment of the diagnoses requested.

d) Daily meeting at 3 pm

The participants are the members of the power operations project team. The meeting deals with the following topics:

- Progress made with work.
- Issuing of the work for the next day based on the schedule.

The participation of the shift operations manager and nuclear safety engineer ensure that nuclear safety is considered.

Each shift has an experienced tagging supervisor whose main responsibility is to carry out tagging activities and real-time monitoring to support the shift supervisor. The system used for control of temporary modifications and maintenance work is generally good. However, the team made a suggestion about the length of time temporary modifications are allowed to be installed in the technical support section of the report.

For each post-maintenance test, a 'requalification record sheet' is produced, defining all verification measures to be performed and ensuring their traceability. The post-maintenance test is performed in two stages: component and system requalification, respectively. Component requalification is performed by the maintenance department and system requalification by the operations department and approved by the shift operations manager.

The requalification record sheet is incorporated into the work request system which makes it possible, even during an outage, to keep a record of these sheets and thereby ensure the operability of components and systems after maintenance work. Operations are incorporated into the site outage project team programme.

The main tasks of operations during outage are to guarantee:

- Plant safety through maintaining the availability of equipment required, depending on plant reactor mode.

- Industrial safety of the maintenance workers through tagging out equipment, stipulating the risks occurring, especially if the tag-out is not consistent with the defensive measures set up.
- Adherence to the deadlines in the schedule for the activities for which they are responsible.
- Operating the systems in operation.

During an outage, the activities are manifold and often carried out in parallel. In order to facilitate this management an outage organisation is set up. The outage project manages all unit outages.

An operations outage team is set up and is responsible for the scheduling of operations activities incorporating the debriefing reviews for nuclear safety, industrial safety and the schedule. It coordinates the interface between operations and maintenance in real time for all activities involving operations.

3.7 FIRE PROTECTION PROGRAMME

The Tricastin NPP fire protection programme follows most international industrial practices. Fire detection relies on a modern fire alarm system.

Actions rely on three organizational response teams. The “first line response team”, staffed by members from the shift teams, is sent out to verify the fire location and isolate the affected fire zone. They get fire protection formal sheets (FAI) directly from the local alarm panel area.

The “second line response team” then prepares for and begins fire fighting.

The third team is the external fire-fighting brigade.

The OSART team observed a fire drill, and found good professional skills but has made a recommendation that the plant should take actions so that fire response times meet industry expectations and best practices.

The team also reviewed fire loading and has made a recommendation to reduce the amount of flammable material in the plant. The plant arrangements to facilitate escape from areas with smoke are above the doors of the plant. These signs may be obscured during a fire and the team has therefore recommended improvements.

3.8 ACCIDENT MANAGEMENT

Accident management is well organized and provides a good response. Roles and responsibilities during emergencies are clearly defined within the operations department.

The operations staff is trained to respond to an accident during simulator training, which includes special emergency training. In an event, the shift operations manager controls operations from the local command post in the main control room. The safety engineer and shift supervisor monitor the unit from the control room. The shift operations manager, as head of the installation, communicates with plant management.

STATUS AT OSART FOLLOW-UP VISIT

In the area of operations, the OSART team made six recommendations and one suggestion. The follow-up OSART visit resulted in one recommendation being resolved and five recommendations made satisfactory progress to date. The suggestion was also deemed to have been resolved. The OSART team recognizes that some of the issues are global in nature and these will require continuous and sustainable effort by the plant.

The team considers the plants efforts to date as significant in improving both plant condition and staff attitudes and behaviors, as well as ownership of the plant by the staff.

The plant has adopted a consistent approach in addressing the issues on Housekeeping Standards, Labeling Standards and Recognition of Deficiencies. This approach has shown to be delivering notable improvements in all of the above issues. Whilst considerable progress has been made, the efforts to further improve, should continue to maintain the momentum.

Changes in the management of equipment line up has occurred, the indicators show a substantial improvement in this area.

Fire team response times have halved following deployment of the response improvements. The improvements in response times as well as to the fixed plant fire fighting equipment and accompanying organization, has significantly strengthened the fire fighting and rescue capability. In support of the reactive response to fires, the fire loading controls have been strengthened to reduce the possibility of a fire occurring as well as the level of the fire load.

In the event of a fire, including smoke filled areas, the plant is testing a fluorescent marking system in December. If successful and with the support of corporate, this could be taken forward for full scope installation.

The team noted that continuous improvements are consistently being made in reducing the levels of discharges of liquid effluent and commend the plant in its pursuit of continuing improvement.

DETAILED OPERATIONS FINDINGS

3.2 OPERATIONS FACILITIES AND OPERATOR AIDS

3.2(1) Issue: Housekeeping practices in units 3 and 4 are below IAEA safety standards and good international practices. Although some deficiencies exist in all units, sufficient standards have been reached in units 1 and 2, but units 3 and 4 are below these standards. The team observed the following deficiencies;

- Dust in the switchgear panels 2LHA, 2LHB, 2LLI.
- Wood and cardboard boxes in turbine floor.
- Wood and garbage below the compressors room in units 1 and 2.
- Oil leakage in Emergency Diesel Generators (EGD's) of unit 2.
- Equipment SRI systems unit 3 very dirty with oil.
- Supply electrical cable not well protected in a pass zone.
- Paint in nuclear area on floor and walls in bad condition with scratches that make it difficult to carry out decontamination works (unit3).
- Heavy material not attached in room of 4RCV001PO, this material could become a missile over a safety related equipment in a seismic incident.
- Dust in electrical panels in unit 4 especially in the upper covers.
- Wooden ladders non-fire coated in fuel building in Unit 4.
- Poor lightning in the room of the spray pump 3EAS001PO.
- A can of lubricant trademark MOLYKOTE was left on the equipment DEG101GF.
- Chilled Water Pump. Handwritten identification in equipment DEG013VD.
- Poor lighting in the room of the equipment DEG101GF.
- Poor housekeeping can cause damage to safety equipment, to the personnel and can cause fires.

Recommendation: The plant should continue its efforts to improve housekeeping particularly in units 3 and 4, to international standards and practices.

Plant Response/Action:

In order to raise housekeeping standards on units 3 and 4, the plant took a similar approach to the action plan set in motion on units 1 and 2.

Housekeeping standards were particularly raised by implementing an action plan, spanning the period of 2003 – 2005, entailing refurbishment of the plant by a minor-maintenance team comprising contractors and plant employees on temporary loan from their departments, in charge of minor house-keeping tasks. Corrective actions consisted of :

- A programme to repaint plant areas;
- Additional lighting whenever it was felt that the latter was inadequate;

- Improvements to condition of equipment tags;
- Improved leak recovery response: Installation of leak drainage systems, retaining devices.

Half-days devoted to housekeeping provided an opportunity for all staff members to play a part in improving plant condition. Involving a large number of plant department members, these half-days were devoted to identifying deficiencies on the plant.

The programme set in place to monitor housekeeping status on the plant has been reinforced in order to ensure that standards are embraced by field operators and to guarantee that improvements are sustained :

- Introduction of a ‘plant ownership’ concept and appointment of plant area supervisors (the plant is divided into areas; each operations shift team checks the condition of the areas assigned to it);
- Introduction of periodic checks by area supervisors. These checks are carried out in accordance with a structured procedure, which describes the respective reference standards and the procedure for recording observations.
- End-of -job inspections by maintenance staff ;
- Reinforcement of management checks on plant condition monitoring ;
- Introduction of periodic checks by management when staff take up their on-call duties ;
- The ‘Coaching Thoroughness in the Field’ (ART) initiative was introduced in June 2003. Job-site housekeeping and respect for plant installations were among the reference standards being focused on by managers as part of their effort to spend more time in the field.

In addition, the plant uses an identification and recording system for ‘plant condition’ deficiencies. This system features the ability to display specific plant condition indicators (housekeeping, equipment identification, leaks, etc.) for each unit, for each shift team and for each area of the plant.

This tool is an effective vehicle for the achievement of ongoing progress in plant condition.

IAEA comments: The plant has adopted a systematic approach to resolve the root causes of poor housekeeping. The process divided up the whole plant into 56 sub areas. 14 Plant Area Supervisors and their teams cover 4 sub areas each. These teams in collaboration with the minor maintenance team have made significant progress to improve plant housekeeping condition.

The plant condition special training video as referenced in 2.7(1) is already used to reinforce the housekeeping standards required. Use of Model areas for each team, set and supported the standards required.

The ‘Coaching Thoroughness in the Field’ (ART) initiative has fully supported this key objective and needs to be maintained for further improvements to be realized. This also includes regular periodic inspections by supervisors at all levels.

Despite the significant and positive progress made by the plant, units 3 & 4 are not of the same standard as units 1 & 2. Next years business plan, if completed, should improve this observation.

Conclusion: Satisfactory Progress to date.

3.2(2) Issue: The plant labelling programme does not meet best international practice or IAEA Safety Standard guidance. The plant labelling programme has encouraged inconsistencies which have caused wrong, missing, incomplete, unapproved and deteriorated labels.

Some deficiencies in the four UNITS were noticed during plant tours. Examples of the types of deficiencies that were observed are the following:

- Lack of labelling in pumps 0DEB901PO and 0DEB902PO.
- Hand written identification in breakers 1RPE006PS, 1RPE00PS8, 1RPE010PS, 1RPE025PO and 1RPE028PO, 2DEG305VD.
- Hand written identification in breakers 3LKH507, 3LKH508, 3LKH509, 3LKH510, 3LKH511, 3LKH028, 3LKH511, 3LKH609 and 3LKH610.
- Demineralized water tanks: 8SED001BA, 9SED001BA identified with small labels.
- Old labels from the construction phase.
- Warning signs difficult to read on "Fyrquel"-tanks.
- Hand written identification in the following equipment and instruments: 4RCV38VP, 4RCV37VP, 8DVN269VA, 3RIS91VP and 3RCP003PO.
- Hand written identification "CEX003MO TN3" placed at TN4 and in operation.
- No label in following equipment: 3DSRO22CR, and no label on valve, below 3ACO001PO.

Unauthorized and uncontrolled labelling increase the risk for human errors and can cause damage to the equipment and personnel.

Recommendation: The plant-labeling programme should be strengthened to achieve a higher standard of labelling that meets best international practice and IAEA safety standard guidance.

Plant Response/Action:

To begin with, a detection campaign was organised in order to pinpoint equipment identification and labelling problems.

This campaign was followed up with sustained actions by the minor-maintenance team and plant area supervisors, as well as half-days devoted to housekeeping focusing on equipment identification and labelling.

An indicator for trending the number of identification deficiencies has been set up and is monitored on a weekly basis.

In 2002, the corrective action programme helped to eradicate more than 2800 identification deficiencies, unauthorized posting of information and handwritten markings. In the first half of 2003, more than 1530 deficiencies associated with labelling and handwritten information were eliminated.

A special labelling campaign was organised to deal with the following issues: Fyrquel, cable trays, hydrogen, CO₂.

This corrective action programme is continuing through 2003.

In addition, a periodic check (every 7 weeks) on the status of equipment identification is being carried out by plant area supervisors.

Furthermore, inspections designed to assess the quality of work-site close-outs, including compliance of equipment identification, are systematically conducted during outages in the reactor buildings.

IAEA comments:

The same systematic approach used for housekeeping has been adopted for plant labeling issues. Data produced by the plant indicates that significant efforts have been made in improving this issue. The same division of areas and teams, including inspections processes and reference standards have been used. Without doubt, a significant improvement was observed in the field, however some discrepancies were observed.

The team would suggest that the plant continues with its current approach, in its endeavour to eliminate labeling problems.

Conclusion: Satisfactory Progress to date.

3.2(3) Issue: The status of all uncommon equipment line-ups is not clearly displayed in one location. The team observed several locations for these line-ups;

- Written pattern is available in the tagging office near by the control room.
- Tagging supervisor does line-ups. He informs operators.
- Information about work permissive line-ups is available in administrative computer facility in main control room.

Lack of visual aid clearly displayed in one location, to guarantee awareness of the status of locally operated and blocked equipment and uncommon line-ups could impede the operator' s ability to take the right decision and actions when the plant is in a transient situation.

Suggestion: The plant should consider displaying the status of all uncommon equipment line ups in one location. Other plants have successfully implanted a type of computerized system that displays the status of safety systems.

Plant Response/Action:

In response to the suggestion and in view of the importance of high-quality line-up work, the Operations department has conducted a self-assessment on the overall line-up process.

Reported difficulties and needs expressed have been factored into an enquiry based on TQM principles and bringing together all kind of operations staff (field operators, control-room operators, tagging officers, etc.).

The plant has contacted a number of other French sites and support has been provided by the corporate human factors advisor specialising in line-ups.

A full description of the line-up process has been drawn up. Improvements aimed at guaranteeing better traceability of line-ups and deficiencies have been made to operating documents used during outage (' line-up tracking sheet').

In addition, a flow diagram illustrating the line-up process is posted in the control room during outages. This flow diagram, filled in by the control-room operators, provides an overview of line-up status from the control room.

Furthermore, the Operations department is currently examining the possibility of using the line-up module in the new version of the AIC programme (Computerized Tagging Aid), which specifies whether or not a valve is lined up.

IAEA comments:

The control of line-ups and its trace ability has been organised to show a clear line of responsibility when the unit is either in outage or at power. For outages a line-up coordinator is used to control and define the line-up requirements, which are independently verified following application in the field.

For the In-Service units, a new version of the AIC programme is in an advanced stage of development. This will enable valve line up confirmations to be verified at anytime for operational reasons as well as indicating the effects of Tag Out operations upon safety related systems. The package also has the facility to include system diagrams. As an aid to the field operator, pictures of equipment inside the reactor building have

been loaded into an equipment identification programme, which shows pictorially, the position of every plant item. This programme is accessible via the LAN. The line-up indicator categories cover 'Safety significant', 'local events' and 'Low level events'. Since 2002, the above levels of line-up deficiencies across the plant, have reduced from: 2, 4 & 9 respectively in 2002 compared to 1, 2 & 4 respectively in 2003. However the level and significance of such events still remains too high to justify a resolution to the issue.

Conclusion: Satisfactory progress to date

3.5 CONDUCT OF OPERATIONS

3.5(1) Issue: Field Operators fail to recognize some deficiencies and supervisors and managers don't coach them to reinforce expected high standards for inspections during their plant tours.

During a plant walkthrough, with a field operator in the compressor room of Unit 1, the field operator did not find pieces of wood, cans, a pipe from the construction phase and garbage under the compressors and no deficiency report was issued. The field operator performed his tour very rapidly.

Other deficiencies that were not recognized by the field operators include:

- Corrosion in compressor in Unit 2, 0 DEB 902 PO and 0 DEB 901 PO, 1 SEC 007 PO, 0XCA002PO, 4SEG027VE, 4RRI031VN, 4RRI003RF, 4RRI002RF, 4SEC028VE, 4RRI004RF and 4RRI032VN.
- High vibration in tubing of the equipment 2GPV175YP. Instrument 2GSS300ZZ.
- High vibration in the actuator of the governor valve 2GPV024VV.
- Loose covers, lack of identification, loose screws on 0DEB901PO and 0DEB902PO.
- Damaged Insulation in pump 2DEG007PO.
- Leakage in OXAA002YG, 0DEB902PO, 0DEB901PO, 4RCV001PO, 4SIT017MG, 4CTA006PO and 4APP139VL.
- Damage in the insulation of cables 4GST.
- Oil leakage in 4RCV003PO, 4SAP001CO, Emergency Diesel Generators (EDG's) in Unit 2.
- Dirty emergency batteries 4LBC001BT (located in room W343) and 4LCA001BT (located in room W342).
- Internal leakage through 4ARE302VL to drain collector. Steam spreading in drain header to other drain collectors.

Inadequate inspection activities and low standards for inspection may result in unresolved safety and operability deficiencies.

Recommendation: The plant should develop a programme to improve the ability of field operators to recognize deficiencies and re-enforce the expectation of managers to coach field operators on high inspection standards.

Plant Response/Action:

An analysis of root causes contributing to shortcomings in the detection of deficiencies by field operators revealed the following weaknesses :

- Field operator training in the monitoring of plant installations is too theoretical ;
- Reference standards fall below expectations ;
- Management is not sufficiently involved in this area ;
- Operations staff have an insufficient overview of how deficiencies are addressed.

These findings were compiled by a working group comprising field operators and managers, with a view to optimising monitoring activities in the field.

The group applied TQM principles and reports to the Senior Management Team on a regular basis in order to discuss and validate proposals made by department managers.

An action plan designed to provide medium and long-term responses to problems raised has been drawn up. It is built around a number of fundamental strategies :

1. Basic field operator training has been reviewed so as to provide field operators with better coaching and preparation for performing their jobs. As part of this effort, an experienced field operator is taken off shift duty to impart his know-how during classroom sessions, followed by coaching sessions in the field.

In addition, measures will be taken to devote periods apart from training time to the acquisition of skills in the field.

2. Reinforced reference standards :On the basis of OSART mission findings and our commitment to achieving IAEA standards, as well as the exchange of good practices with other plants, our reference standards with regard to plant condition have been reinforced.

These reference standards have been presented in a document designed for use in the field. They have been conveyed to each team by means of field training sessions.

They have also been incorporated into periodic plant-condition checking procedures.

The plant has been divided up into 28 areas per twin-unit group, with a supervisor assigned to each area (14 area supervisors for 4 units).

The supervisor's job is to periodically take stock of the area assigned to him and to track any deficiencies encountered.

A seminar was attended by area supervisors in 2002, enabling those involved to exchange experiences and suggest areas for improvement (e.g. assigning responsibility for plant areas to every field operator).

3. Management involvement: Management has also made a significant contribution to improving plant condition through their co-ordination of the area supervisor network as well as their co-ordination of the "operator rounds" working group.

In addition, the Operations Department held a benchmarking workshop comprising 14 sites focusing on the detection of defects in the field. This exchange of experience provided us with good practices in the conduct of rounds during outage and in the scheduling of various types of round.

In addition, management has drawn up a operator rounds coaching programme as well as a plant monitoring oversight programme: The teams (shift manager, shift supervisor, tagging supervisor or control-room operator) have to carry out at least 3 management observations of rounds in the field over a 7-week period.

The aim of this coaching programme is to coach staff in complying with reference standards in the field, to discuss difficulties in applying these standards, to check that plant-condition reference standards are met and to correct any deviations that might be encountered.

These observations are checked in terms of quantity and analysed in terms of quality. A preliminary experience feedback report based on these observations will focus on the organisation of computer rounds.

These actions will be accompanied and supplemented by other actions designed to ensure the cross-functionality of plant monitoring and upkeep (cross-functional teams consisting of people from operations, mechanical maintenance, I&C, electrical maintenance and cleaning staff for the immediate rectification of minor deficiencies). These proposals, submitted by the “operator rounds” working group, are currently being implemented by the plant on a trial basis.

4. An accurate overview of how deficiencies are detected and addressed. The volume of deficiencies being detected and a lack of oversight regarding their prompt resolution led to a loss of motivation among our workers.

The deficiency processing software programme specific to plant condition was upgraded in order to :

- enable plant area supervisors and field operators to monitor deficiencies in a more targeted manner ;
- visualise plant condition standards in each area by means of indicators established by the quick minor-maintenance team and plant area supervisors. This indicator also trends corrective actions on discrepancies.

A specially designed information campaign channelled through the plant area supervisor network, followed by meetings between the minor-maintenance team and various shift crews, were instrumental in disseminating the results of this combined effort, thus helping to sustain the progress made by operations teams in the detection of deficiencies.

IAEA comments:

Again the same systematic approach used for housekeeping and labelling has been adopted for identifying plant deficiencies. Data produced by the plant indicates that the difference between the number of deficiencies raised by the operator and the number rectified is very small and slowly reducing.

Production of appropriate reference standards when used in conjunction with coaching in the field has made significant inroads into identification and rectification of deficiencies. Again the model areas have contributed to staff being able to see what can and is being achieved.

Field operators guidelines have been produced to bring together all the expectations required of a field operator, this has also given further clarity of their responsibilities. Without doubt, a significant improvement has been observed in the field, as well as a sense of pride by workers. However the team believes that further progress can still be made in this area and that the current approach should continue.

Conclusion: Satisfactory Progress to date.

3.5(a) Good Practice: The site has a very effective programme for minimizing liquid effluent releases. The operations department has been a driving force behind a site programme for minimizing liquid effluent releases. It was observed by the team that

Tricastin NPP has moved from a very poor position among other EDF plants to the third best position. The amount of released liquid effluents has dropped from 5.5 GBq (1990) to 1.5 GBq (2001). At the end of 2001, the release rates were less than 50.0 MBq/month. Tricastin's goal is to become ISO 14001 certified by 2003 and this accomplishment will help achieve this aim.

Site management has emphasized the involvement of all plant stakeholders in this initiative. An effluents team, consisting of seconded technicians from the operations, chemistry, radiation protection and maintenance departments, has been formed and manages the overall programme. This methodical involvement of seconded technicians from all of the departments that can influence either the production or processing of effluents has been the single most influential factor to the success of this initiative. Most notably, the auxiliary operators from the Operations department have assumed a personal ownership for and commitment to the success of this initiative. They have become the driving force in the results that have been achieved.

First, the auxiliary operators have dealt with the production pathways for liquid effluents. They have worked with the reactive maintenance team to identify and eliminate the sources of liquid effluents (e.g., primary coolant leaks). Their success can be measured by the fact that over the past 2 years, the input volume has been decreased by 90%.

Second, on a daily basis the auxiliary technicians record the volumes in the various tanks. They then enter this data into a dedicated effluent computer application (TEU), developed by the plant. This application, allows for the accurate tracking of the activity and volumes of all liquids in storage. More importantly, it provides the means to segregate longer lived radionuclides, such as Co-60, thereby minimizing the cross-contamination of tanks and the associated increased releases that would occur.

A third improvement has been the addition of a special filter to trap AG110m. This improvement was made as a continuing improvement effort, possible once the initially high release rates had been remedied.

Finally, the programme has been assisted by the categorization of liquid effluents into four "families." This simple categorization enables all levels of the staff to appreciate the importance of reducing liquid radioactive waste quantities and to understand how best to dispose of them.

3.7 FIRE PROTECTION PROGRAMME.

3.7(1) Issue: Fire response times that are demonstrated during exercises were observed to be unusually long.

In a fire fighting exercise, the response of the on-shift team was delayed. The communication to the offsite fire brigade caused delay in its response. Debriefing by plant personnel identified the reasons for the delays.

Undue delay of fire fighting can cause a significant threat to the safety of the plant.

Recommendation: The plant should assure that the fire response times are adequate. The plant is recommended to review and improve the fire fighting arrangements and performances to assure that after an automatic fire alarm in the control room is received, the fire fighting by on site or off site fire fighters can be assured in a reasonably short time.

Plant Response/Action:

In order to limit fire-fighting response times, Tricastin NPP has introduced a programme which is built on three cornerstones:

- Scheduling of periodic drills;
- Optimisation of drill logistics;
- Co-ordination of a fire-fighting network whose role is to determine areas for improvement.

Drills are carried out every Friday afternoon at a location determined by duty shift managers. A surveillance test entitled 'JDT 100' was designed in order to monitor the conduct of these drills. A copy of the surveillance test debrief is sent to the shift teams in order for them to correct deficiencies for which they are responsible. Observations made during these drills have helped to list a series of shortcomings or deficiencies which are then used as material for fire-protection training, recently developed for shift teams.

A drill tracking table has been drawn up in order to track the role of each participant, as well as response times achieved (performance).

Response times have been improved as a result and are now compliant with standards laid down by corporate fire-protection policy.

The fenced-in area used as a changing facility for second-line emergency response teams has been replaced by a 'portakabin'. This building has been fitted with cabinets containing equipment belonging to each team member. It has also been equipped with a telephone, a map showing emergency muster points, a table and a white board, etc. Additional self-contained breathing equipment and a stretcher have been provided. Cleaning arrangements have been made for hoods and overalls.

Fatality detectors and pre-initialised dosimeters will be installed, while new lifelines with personal connection cables and new adjustable hoods have been sourced in 2003.

A vehicle designed to accommodate changing-room equipment was purchased in mid-2003. It replaces emergency muster point no. 4 and takes the equipment directly to the muster point at the location of the fire. A new search system is also planned. These

two aspects should help to improve performance in terms of efficiency and response time.

For co-ordination purposes, the Operations department has instituted a full-time Industrial Safety Committee consisting of one field operator per team, one shift manager and two chief rescue officers. Its role is to adapt Fire-Protection Committee decisions to department requirements as well as to decide upon and resolve all issues associated with industrial safety and consequently with fire protection.

With regard to actual organisational measures deployed in the event of a fire, the role of first and second-line emergency response teams has been redefined and set out in a cross-functional department memorandum. A new SII procedure (specifying what to do in the event of a casualty or fire) has been introduced as a means of improving the emergency-services call-up procedure. Experience feedback from drills conducted in various parts of the installation is regularly incorporated when this procedure is updated.

Our results in terms of response time have highlighted significant improvements. For instance, the response time of the second-line response team was brought down by eight minutes for remote areas, as a result of fire drills and subsequent organisational changes. Response times have been reduced by another five minutes through the use of the fire truck.

IAEA comments:

Following a seminar on the Fire Response issue, a number of actions were taken to significantly improve the fire team response times. These included the deletion of muster point No 4 as the storage point for fire fighting equipment. This was temporarily replaced by an outside portakabin to improve communications and facilities. The training of fire team members was improved, especially within operations department. An equipment vehicle with trailer replaced the portakabin. Following confirmation of a fire, this is driven by security and delivers the fire fighting equipment to the nearest muster point to the fire. The fire team is also summoned to the same identified muster point using personal beepers. Further to this, two fire drills per week are carried out to keep the teams at peak performance, one by security staff and one by the operations staff. The net result of the above actions has been to reduce the second line emergency response teams average response time from 30 minutes in August 2002 to 15 minutes in November in 2003.

Conclusion: Issue Resolved.

3.7(2) Issue: Transient fire loading in all plant areas is not fully controlled.

Examples of transient fire load found by the team are:

- Some wood stored in Unit 1 between floors.
- A lot of wood and cardboard boxes inside the plant especially in the turbine floor.
- Use of wood in Radiation Control Area for scaffold support.
- Accumulation of inflammable materials (wood, paper, etc) in turbine building.
- Wood is used in the reactor building (of Unit 3 during the outage and the turbine hall).
- Wood was stored in unit 1 near tank 1 JPT 051 BA.
- Dust in the switchgear panels 2LHA, 2LHB, 2LLI.
- Wood and cardboard boxes in turbine floor units 1 and 2.
- Wood and garbage below the compressors room in units 1 and 2.
- Oil leakage from emergency diesel generator A and B of unit 2.
- There was an open barrel of oil on the turbine floor between units 2 and 3. Cigarette butts were found in a drain a few meters away.
- Significant oil leaks in the RCA around the unit 4 charging pumps.
- In the pump rooms of unit 1 no deficiency tags were observed for small oil leaks, which raises the question as to whether tags should have been used.
- Equipment SRI system Unit 3 very dirty with oil and supply electrical cable not well protected in a pass zone.
- Oil leakage in EDG's (LHP/LHQ) of unit 2.

Flammable material increases the risk and consequences of fire.

Recommendation: The plant should establish and implement a policy regarding the transient fire load in the plant. This policy should be re-inforced during periodic training activities.

Plant Response/Action:

The plant has analysed the root causes which resulted in the following findings:

- Fire-load reference standards were not specific enough
- The people involved had not been made accountable
- The site had not set up checks in this area.

We identified the following areas for improvement:

- Application of a new fire-protection policy and drafting of plant-specific reference standards;
- Compliance with various storage categories, locations and associated limits;

- Raising awareness of all workers, including EDF staff and contractors, with regard to fire hazards.

DRAFTING OF PLANT-SPECIFIC REFERENCE STANDARDS

The corporate fire-fighting policy ("FIRE-LOAD MANAGEMENT RULES - D4008.27.10.01/342") has been deployed on the plant via a local set of standards described in a document bearing the title 'FIRE-LOAD MANAGEMENT' - D5120/SRM/NTS/96020-C. This document covers all possible storage locations and methods: fire safety zones, fenced-in areas, portakabins, containers and transient fire loads.

In the appendix, a description is given of the tool used to calculate fire-load density, together with a software programme used to make quick calculations.

Furthermore, a corporate enquiry is being conducted on storage conditions and locations, whether temporary or permanent. An initial calculation of combustion times was carried out during the design phase, and the design and installation of storage-areas should not increase this risk.

MEASURES ADOPTED IN ACCORDANCE WITH STORAGE CATEGORIES

Fenced-in areas, portakabins and containers

Responsibility for each fenced-in area, portakabin or container is assigned to a specific person whose name is indicated in the field. That person is responsible for housekeeping arrangements and compliance with regulations governing access of operations staff to his area, as well as the definition and visual display of existing fire load density in that area.

TRANSIENT FIRE LOAD

Job-sites should contain the smallest possible amount of combustible materials and comply with appropriate packaging requirements (safety containers).

RAISING AWARENESS OF PLANT STAFF AND CONTRACTORS

In November 2002, a campaign was organized to raise staff awareness and implement plant reference standards. It involved all persons in charge of fenced-in areas. A computer programme specifying the different values specific to each substance and the various factors to be included in a fire-load density calculation was provided.

In addition, a campaign to raise staff awareness regarding adherence to fire-load density rules was organised during the outage seminar in January 2003. Messages were regularly broadcast over the site video network.

Lastly, members of the SRM department conduct jobsite walk-downs, paying particular attention to compliance with fire-protection standards. Preventive measures set in place for the management of hot-work permits include periodic job-site inspections.

IAEA comments:

Training of all EDF plant staff was carried out to emphasize the importance of excessive fire loading of plant areas. Fenced areas designated for the storage of combustible materials, are controlled by specific individuals, to ensure the fire loading

limits are not contravened. Many of these areas are locked as a means of preventing unauthorized fire loading. To support this requirement, standard references have been drawn up and controls such as Hot work permits as well as periodic checks, are used to ensure that fire loadings are kept within limits. However further efforts are still required to ensure adequate controls are consistently applied at temporary work sites.

Conclusion: Satisfactory progress to date.

3.7.(3) Issue: Emergency exit pathways and signs are not sufficiently observable during high smoke and steam conditions. Emergency exit lighted signs are placed above doors where smoke could hide them during a fire.

With poorly marked escape routes, personnel could experience difficulty finding emergency exits during fire or steam leaks.

Recommendation: The plant should take measures to facilitate escape from areas during a fire. Some facilities use fluorescent paint to mark escape routes.

Plant Response/Action:

A preliminary feasibility study was carried out on floor markings designed to indicate ways towards emergency exits (usable substances, associated evacuation plans, etc.).

The corporate fire-protection representative was consulted in order to validate the magnitude of the proposed measure and to gauge the potential impact on all EDF plants.

In agreement with corporate headquarters, it was decided to conduct a trial in two particularly high-risk areas with regard to evacuation (3.80m-level of the electrical building on all units and emergency turbo-generators (LLS) on all units).

The adopted system enables anyone to move towards the building emergency exits in smoky and unlit conditions, thanks to fluorescent markings on the floor.

Experience feedback on the benefits and effectiveness of this arrangement will be exchanged with headquarters.

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IAEA comments:

Some progress has been made by the plant. 8 routes have been marked with fluorescent tape as a trial for a possible full scale programme. The marking tapes work very well in dark conditions, however a final test using smoke, will be carried out in December with corporate representatives observing. The success of this test could lead to full scope deployment. The team noted that the method of fixing the trial tape would need to be more professionally fitted, if this was permanently adopted.

Conclusion: Satisfactory Progress to date.

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

Maintenance responsibilities are shared between a mechanical maintenance department comprising about 193 persons and a department combining I and C, electricity and industrial data processing of about 172 staff. Other maintenance services such as housekeeping, scaffolding and warehousing are provided by other departments. A separate project-based structure is established to manage outages and power operations. All the department heads report directly to the plant manager.

While this is not the typical organization seen in the industry, roles, responsibilities and goals for each department are clearly defined and understood via a memo (contract) between the plant manager and direct reports. Each department however, operates in an independent way converting policy to practice, each having their own tools and developing their own programmes from common policy. During the past 3 years the maintenance department has set up a process to tighten their management by applying similar procedures in both organizations and to improve easy communications between their teams. Additionally a series of cross-functional processes such as the “power operations team”, “outage project” and the “Top Ten” policies appear to apply the necessary plant integrating factors. The integrated set of cross-functional meetings known as the “power operations team”, includes a combination of the various processes, information dissemination and meeting activities which make this application very useful to manage daily activities.

The management appears adequate to control the maintenance backlog which in the past 5 years was reduced by one third with the average delay also being reduced, through the improvement of work preparation quality with safety, industrial safety and radiation exposure analysis assessed at the same time.

A large part of maintenance work is subcontracted, especially for outages. To correctly monitor contractor activities, the maintenance departments have trained a motivated team to monitor from the beginning until the end of their work, calibration of tools and testing equipment, safety, industrial safety and ALARA criteria according to contract terms with special care in technical proficiency during the execution of the work by the contractor. The way the contractor relationship is handled by the plant includes developing good contractor skills and a focus on improving plant performance and is considered as a good practice. At corporate level this practice has been highlighted as a good approach.

In each department, a methods branch composed of job planners with a technical background is responsible for the introduction and adaptation of all the modifications required in site maintenance programmes and procedures, that includes changes in corporate maintenance programmes, Safety Authorities requirements and Operating Experience feedback. These teams are very proficient and produce a very consistent Maintenance Package for execution.

Work packages are prepared and include all the risk analysis, procedures, requalification tests, materials and resources for a complete documentation. This provides the structure for work teams to work with as few unplanned occurrences as possible and good documentation.

The plant has several databases used by maintenance. The computerized work management system SYGMA, software developed for all the French nuclear power plants, is the major maintenance management tool. Based on SYGMA data and established communication channels, corporate departments have an enormous amount of information, including operating experience feedback with the information coming from all similar plants.

A major strength is the corporate ability to provide, on a real time basis, maintenance experience, and equipment to all its plants.

The tagging system is not integrated in SYGMA, but is implemented with other programmes by the operations department. The integration of these activities as a module of SYGMA would improve interfaces between the Maintenance and Operations departments. Additionally, the introduction of the concepts of workflow or bar-coded documents computerized management systems would improve the reliability and speed of the process.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

Each of the maintenance areas has well equipped workshops with good standards. There are also workshops in radiologically controlled areas.

Tool storage has good controls to prevent damaged equipment from being reissued. Special fireproof cabinets were available for the storage of chemicals and flammables.

Mechanical maintenance uses a bar coding system to link tools to people and jobs. Electrical maintenance has a warehouse with an effective system to properly manage and track calibration equipment with adequate procedures.

Calibration of measuring instruments and tools are performed on a regular basis by contractors. For items which require regular checking, such as torque wrenches and some measuring instruments, a calibration verification capability is maintained within the applicable maintenance section. Calibration records are up to date and complete.

Training facilities and mock-ups are available for major maintenance activities.

Lifting equipment is normally tested annually by a qualified contractor and mechanical warehouse equipment labelled with the year of authorized use with a coloured plastic ring for easy identification. Slings and hooks from the plant have bar-coded identification labels that differentiates them from the equipment supplied by contractors. Contractors are required by contract to supply certification of their slings and tools but at the moment is difficult to identify this material in the field.

Tools for use in controlled areas are stored in a storage room and are not used outside the RCA. When a tool or item of equipment is taken out, it follows a specific procedure.

There is a specific storage area for oils; however improvements should be made to identify the oils issued, in order to comply with the ISO14001 standard that will be part of the objectives of the plant for next year.

There is also a steel warehouse where carbon steel and stainless steel are clearly identified.

Temporary installations (TI) are managed according to a procedure defining the installation process. To implement regular TI, the mechanical department has set up small storage areas in the field for each Unit and the areas with materials required for every TI clearly identified and installed in the installation with adequate connections. The electrical department has two specific storage rooms, one for cabinets and instrumentation devices and another for grounding equipment. Through this enhanced practise, the installation and management of TI is made quicker and easier.

4.3. MAINTENANCE PROGRAMMES

The plant has a well-defined preventive maintenance (PM) programme commensurate with the importance of the equipment. The programme used throughout EDF is based on internal

and international experience. The site adds its own specifics for non-safety related systems and complies with corporate requirements for safety-related components. The Plant has improved dramatically since changing its PM programme over to a Reliability Centred Maintenance programme (RCM). Predictive maintenance techniques such as vibration monitoring, valve diagnostics, thermo-graphics and oil analysis are all utilized to adjust the PM programme and some of them are used to inform the head office and other plants of results.

The overall In-Service Inspection (ISI) programme is clearly defined for safety related systems by head office and the plants programme and perform the work to an agreed schedule. There is a comprehensive process for handling deviations with considerable expert advice available from corporate resources.

The corrective maintenance programme appears to be efficient with a well-managed work control system in place. All work requests, deviations and maintenance records are stored on the SYGMA system and accessible to all personnel with a need at the plant. The identification of deficiencies, out of tolerance results, safety-related events or low-level defects are managed using a specific module of SYGMA called “discrepancy processing” (Traitement des écarts).

4.4. PROCEDURES, RECORDS AND HISTORIES

Every maintenance task at the plant has a work order that contains, when appropriate, nuclear or industrial safety risk analysis, procedures to be applied or hand written instructions, tagging documents, results and a history of the job. In general such packages are well managed and compiled, but some of them could be improved.

The documented history of the plant is available in a main document control system and satellite centres. Documentation is well controlled and easy access is available by computer.

Maintenance documents reflect safety culture principles, including policies on procedure quality, procedure compliance, self-checking and the requirement to stop work if the worker is in doubt.

4.5. CONDUCT OF MAINTENANCE WORK

Overall, maintenance is performed conscientiously and professionally by staff well trained in their specialized skills. Procedures are followed and in most cases, deviations diligently reported. There are however some specific maintenance and support activities areas where observed standards need improvement. For example improved standards in personnel safety and radiation protection, storage of material and job site conditions postings would be appropriate. In addition a clear policy should be enforced to ensure that the worksite is left tidy after maintenance works have been completed in areas where safety related components are installed. A strengthening of performance and management oversight in these areas is recommended. In particular improvements to foreign material exclusion practices in the spent fuel area, reactor cavity and in general when circuits and main components are open. The team made a recommendation in this area.

An improvement programme has been implemented for maintenance management staff to be present in the field demonstrating high standards, monitoring job performance, reviewing safety conditions and equipment status, during plant operations and during outages. This

practise is considered as a good practice. But in several areas, a need for improvement was observed in terms of industrial safety and radiation protection standards, as well as the identification of low-level plant and equipment deficiencies.

Significant operating events are analysed in depth with a clear assignment of responsibilities and actions which are effectively monitored. Personnel involved in the event take part in the analysis process and results are made available to the plant. This remarkable participation of staff allows the use of event analysis as a good tool to spread safety culture.

4.6. MATERIAL CONDITIONS

The material condition is good in units 1 and 2, but requires many improvements in units 3 and 4; in particular the turbine hall and auxiliary building BAN08. Degraded surfaces on floors and walls, inadequate lighting, poor condition of paintwork on equipment, thermal insulation degradation, smaller pumps and auxiliary systems insufficiently maintained and some equipment showing degraded aspects were noted in units 3 and 4. The degradation process trend is dynamic and could affect in the short term other equipment important for availability or safety. It is difficult to maintain good standards of works forgetting material conditions around the plant.

The team recommended the Plant to improve the condition of units 3 and 4 and bring it to at least the same level of material condition as units 1 and 2 as soon as possible.

4.7. WORK CONTROL

Two different projects ‘Power operations’ and ‘Unit on Outage’ have been set up to control and coordinate all the activities. Three daily meetings with a quick and effective process brings together the various departments involved in getting work done on the different projects and enables them to work together in a well disciplined manner.

The work prioritization process and the work control system are taking material and manpower considerations into account and designating achievable timelines. All the activities are prioritized and problems are discussed for general information and decision-making.

All activities are scheduled, corrective maintenance works are incorporated every day and the progress of activities is integrated daily in the planning tools to provide detailed information. Specific actions are implemented when problems occur during an activity, and these actions are followed in the coordination meeting.

At the execution level, two daily meetings in each department give general information about the units status. An effective work distribution and quick information about problems affecting works in progress provide a diligent feedback to the project management.

The organization is very heavy and a lot of different participants are involved in work execution. But the projects organization, with a cross-functional vision, maintains an adequate control and coordination in unit activities.

4.8. SPARES PARTS AND MATERIALS

The plant has a main warehouse to manage all the concerning receiving and dispatching activities, quality assurance packages, stock control taking into account all the requirements in terms of storage and shelf life. The warehouse also prepares packages of parts that are supplied to the work team perfectly packed, just in time during normal operation and especially in outages works.

All spare parts are accurately identified and properly packaged. The packaging material is renewed according to a shelf life programme.

A high level of quality is found in this area and the warehouse management, with its closed loop material supply process should be considered as a good practice.

4.9. OUTAGE MANAGEMENT

Outage management is performed well according to a long-term plan developed by the head office and the plant. Dedicated resources and a strong management team have been developed with considerable project management expertise. A managed process with structured meetings has been developed to keep tight control of outage activities and a quick response to deviations. Detailed planning and work package preparation starts six months before an outage and changes are frozen four months later. Nuclear and industrial safety experts are part of the team and pay special attention to planning and maintaining adequate assurance of safety margins throughout the outage stages. An outage execution team is assembled from experienced people on the running units starting six months before the outage. From the time of their secondment to the end of the outage they are dedicated to outage work. Three types of outages are defined: a simple refuelling outage lasting about 35 days, a normal maintenance outage about 45, or a ten-yearly outage which duration varies according to the package of modifications required.

The planning tools based in OPX2 software and related applications give to the project management the information required to ensure a full perspective and details to make the right decisions. Additionally, the operating experience feedback is incorporated, and simulations and forecasts can be drawn up for the long term planning.

STATUS AT OSART FOLLOW-UP VISIT

The plant has made good progress on the maintenance issues. The two recommendations were found to have made satisfactory progress to date.

To make the required improvements in the area of material condition and housekeeping, a minor maintenance team has been set up, with rotation of personnel from the maintenance departments to disseminate awareness of problems associated with this issue. This team will be integrated into the operations department, which is responsible for overall control of the process from detection through to repairing the deficiencies. The team observed that the setting up of reference areas (model rooms) can be beneficial for training and raising awareness in the detection of deficiencies.

The new diagnosis team, working in close cooperation with the operations shift teams, improves efficiency of maintenance activities allowing adequate control of the backlog of maintenance tasks.

To address the issue concerning foreign material exclusion, the plant has implemented an reinforced programme including raising the awareness of both plant staff and contractors of

FME risks, introducing new devices for protecting open circuits, special tools to avoid falling objects and implementing FME zones with effective controls and signposting in the field.

The team observed improved attitude from staff concerning adherence to industrial safety rules. Expectations are systematically communicated to both staff and contractors during pre-job briefings.

The team viewed positively all the actions and resources mobilized by the plant to address effectively all the aspects linked to the Fyrquel issue. In particular, maintenance took a leading role in the efforts to resolve this problem, investing significant time and energy in this area..

DETAILED MAINTENANCE FINDINGS

4.5. CONDUCT OF MAINTENANCE WORK

4.5(1) Issue: The plant policy to avoid introduction of foreign materials in equipment and pipes is not effective. The control of the plants foreign material exclusion (FME) programme was weak in several areas of the plant.

- The team found numerous examples of metal shavings, copper wire, clear plastic, nuts and metal washers on the floor near the open reactor cavity.
- During the time of the OSART mission a worker dropped a dosimeter into the fuel pool.
- The plant has experienced an event where foreign materials cause an electrical short in the main generator, which resulted in a plant trip.
- Personal working in the turbine hall of unit 3 did not control small things in their pockets. The team observed that tools could fall inside the open turbine and no signs showing precautions had been installed. This work area was also not limited for access.
- Manholes opened in different heat exchangers are not closed or covered to avoid the introduction of foreign materials.
- Isolation works in the new steam generators (SG) do not have not enough protection devices to avoid foreign material from falling into the reactor cavity.

Foreign materials could cause damage in safety related equipments and could contribute to damage in fuel elements or SG tubes resulting in broken safety barriers leading to radiation release. Foreign material in the turbine or generator could also lead to plant transients.

Recommendation: The plant should improve their FME programme in order to ensure that safety related and important equipment and structures are adequately protected from damage.

Plant Response/Action:

The plant initiated the first stage of an analysis aimed at identifying the root causes which led to the recommendation on foreign-material exclusion. Three main points have been highlighted :

- Lack of knowledge concerning the risk of foreign-material intrusion;
- Lack of clear and common reference standards;
- Inadequate management of this issue as a whole.

On the basis of this diagnosis, four areas have been identified where cross-functional and co-ordinated actions will be needed:

- Reference standards: define and itemise reference standards;
- Communication and raising of awareness;
- Provision of appropriate resources, devices or tools;
- Management: Monitor application of reference standards; perpetuate results and good practices.

DEFINITION OF REFERENCE STANDARDS

The plant has established a set of reference standards on the subject of foreign-material inclusion risks. These standards require that all possible means and devices be employed on all open sections of a container, circuit or spare part, in order to prevent the inadvertent introduction of foreign materials.

On circuits, all openings must be protected by a special device.

Areas with a stricter housekeeping code have been set up around job-sites susceptible to the introduction of foreign materials:

- around the reactor cavity pool and fuel pool (20 m-deck) ;
- when large components are being opened ;
- on the polar crane ;
- in electrical or power cabinets.

The measures in force in these extra-clean areas are :

- limited access, requiring permission from the area supervisor ;
- suitable clothing (dosimeter, film badge, security badge and pens must be properly secured) ;
- tools and instrumentation must be properly secured.

Cross-functional department memoranda (core unloading procedure) specifying the requisite preventive measures to be taken around the reactor cavity and fuel pools have been revised in order to incorporate new requirements.

Maintenance reference standards now include this requirement.

A foreign-material risk assessment was carried out by the technical advisory group. This assessment identifies the risk of foreign materials falling into the pools.

Conveying expectations.

The plant has implemented the following actions :

- The foreign-material issue is systematically addressed at meetings with contractors ;
- A guide intended for use by contractor supervisors is designed to facilitate assessment of job-site tidiness and foreign-material risk. It is also designed to rectify any deficiencies ;
- The training curriculum for contractor supervisors includes a module on operational safety standards, including foreign-material risk ;
- An information campaign presenting the various foreign-material exclusion devices, as well as the means of obtaining them, was broadcast via the site video network ;
- Foreign-material exclusion devices have been displayed at the site entrance and in the outage-building lobby during outage periods ;
- During management meetings, the project manager periodically reports on the progress of OSART recommendations, including the recommendation on foreign-material exclusion.

MEASURES, DEVICES, TOOLS AND BARRIERS SET IN PLACE TO PROTECT EQUIPMENT FROM FOREIGN MATERIALS

To protect equipment from foreign materials, the plant has taken the following actions :

A preventive approach, implemented from the planning phase onwards, aims to ensure that no foreign material can be overlooked or lost. This requirement appears in various documents used by the plant, depending on the activity and the significance of the identified risk :

- Prevention plans ;
- Risk assessments ;
- Work procedures (housekeeping hold-points for valve-related activities) ;
- Supervisor’s monitoring procedure ;

They may also take the form of actions defined during kick-off and prerequisite action meetings.

Posters warning about the risk of objects falling into the reactor cavity and fuel pools inform workers of applicable standards and provide recommendations in this regard.

Measures have been taken in order to prevent the loss of components which could result in a foreign-material risk situation. On the refuelling machine, for example, moving parts have been secured.

The use of clear plastic has been ruled out when performing work around the pool edge. Black plastic is now used instead and handling instructions require that equipment is unwrapped away from the pool edge.

During pre-job meetings, work-team leaders in charge of sensitive activities around the pool edge are requested to secure tools by means of a rope tied to a fixed point.

Locking of electrical and power cabinets is also checked during field inspections.

In order to implement these requirements, it was necessary to purchase equipment designed to guarantee the physical exclusion of foreign materials :

- Foreign-material exclusion devices, with a red colour-code for secondary systems;
- Foreign-material exclusion devices, with a yellow colour-code for primary systems;
- Special manhole tools for vessel openings;
- Special tank tools for maintenance of electrical breakers;
- Special polycarbonate barrier tools for marking off “extra-clean” areas around reactor pools

MANAGEMENT : MONITORING AND PERPETUATING GOOD PRACTICES

Plant management has been involved in monitoring the application of standards and in assessing staff involvement.

The industrial safety grading chart was modified in 2003 to include a section on foreign-material exclusion procedures.

For all outages scheduled to take place in 2003, the plant has appointed an assistant to the Outage Manager, entrusted with the task of itemising and monitoring the

correction of job-site deficiencies identified through the OSART recommendations, including the foreign-material exclusion issue.

In spite of these actions, the discovery of foreign material that had fallen into the pool during unloading operations on Unit 4 (June 2003) revealed the shortcomings of adopted measures, particularly with regard to raising contractor awareness on these issues. Indeed, a sensor and its packaging were left behind in the fuel handling cask by a contractor carrying out maintenance on the machine and they then fell into the reactor vessel area when the machine was being used. The lower internals had to be removed in order to extract the object.

In addition to immediate corrective actions taken to remove foreign materials, the following actions were implemented :

- a meeting with the contractor, followed up by a letter requesting him to draw up an action plan to prevent the recurrence of such negligence ;
- Drafting of an experience feedback document in order to analyse and resolve the issue ; definition of additional preventive actions to be implemented and included in work procedures. These actions will reinforce existing measures.

IAEA comments:

The plant has developed an extensive programme for foreign material exclusion (FME) with effective actions.

Although the plant experienced an FME event during a refuelling outage in June 2003, the actions taken in response to the event and the OSART recommendation appear to have the right direction.

Standards have been set for this issue, defining FME zones with protection, supervision and specific rules in the operational levels around the reactor cavity and fuel pool. Additionally, there is a range of components and tasks that require protection during circuit openings, covering both mechanical and electrical components. When significant FME risk is identified following the risk analysis prior to a specific job, the department concerned can require areas such as the spent fuel pool or reactor cavity to be completely covered with a sheet if needed.

FME is included in work order packages, with specific hold points in quality assurance programme and in risk analysis.

Information on FME is provided to staff and contractors at all levels in their organization.

The plant has introduced into procedures requirements concerning the use of protection devices adapted in each case to open components as well as special tools for performing tasks where there is a risk of objects falling inside equipment or open circuits.

The organization has a capacity to response quickly and effectively in case of an incident, as shown in the response to the event of June 2003.

In order to consolidate this programme within the organization, a thorough follow-up during the next outages is recommended.

Conclusion: Satisfactory progress to date

4.6. MATERIAL CONDITIONS

4.6(1) Issue: On both units 3 and 4, the material conditions are not consistent with IAEA safety standards and good international practice, and a general state of degradation exists. On units 1 and 2, although great improvement has been accomplished, some improvements could still be made. The team observed the following conditions:

- In plant common areas and thoroughfares of BAN 08, there are a lot of cracks, paint peeling and debris in the drainage channels that prevent water from fully draining.
- Contaminated tools and equipment had not been stored inside the contamination area, making it possible to spread contamination to other plant areas.
- Within a contamination area, supports and equipment have been removed, leaving walls with holes and unpainted surfaces.
- Plant rooms containing charging pumps 3 and 4 RCVxxx PO have the same type of problems. e.g. the pump plinth had not been painted which would lead to further contamination problems.
- The temperature in pump room 4 RCVxxx PO that is running is significantly higher than that of the equivalent pump rooms in Units 1 and 2.
- Small leakage with boron traces was observed in 4RCV001PO and 4RCV002 PO.
- Pipe and equipment thermal insulation materials have deteriorated in several places in turbine building hall. e.g. auxiliary pipes around TPA APP, APP139 VL, pipes in the area around pump system GFR.
- Paint on big and small materials are deteriorated and the team found several materials with dust, oil and leakage or remains of old leakages. e.g. All 4CTA006 PO deteriorated aspect and significant external leakage in 3 pumps. TPA s APP system, 4ACOxxxPO, 3 and 4 SRIxxx PO, SAP001CO air compressor with oil leakage, which seems regular, 4RRI001 and 003PO dirty with grease spreading.
- 4GSYxxxPO protective panel had been remove on 18-12-01 for a work, which has not started yet (23-1-02).
- A valve sealed with “furmanite” several times (unnamed) near 4ARE302VL.
- I & C cables are poorly protected in points going out from rigid conduits or entering in sensors with cover damaged. Special attention must be paid for sensors installed in areas with systems where a potential H2 leakage could occur. Systems GRH generator hydrogen-cooling system and GST stator cooling water system. In the cables of sensors 3GRH and 4GST deficiencies have been detected.
- Some instrument tubing is in contact with other tubing. Friction is creating wear.
- Level switches in sumps in turbine buildings 3 and 4 are not correctly supported.
- 4SIT017MG leaking water.
- Battery rooms W342 and 343 present bad state of cleanliness and remains of acid stains on the floor.
- Poor lighting in rooms or areas e.g. 3EAS001PO, 3DEG101GF, TPA’s areas.

The material condition degradation process trend is dynamic and could affect, in the short term, other equipment important for availability or safety.

Without keeping plant equipment and structures in good material condition, a state of

gradual plant degradation could exist. In addition, plant personnel will become used to accepting a lower standard for plant material condition than that expected by good international practice and IAEA safety standards.

Recommendation: The plant should improve the material condition of Units 3 and 4 to equal or better standards reached in units 1 and 2. Although units 1 and 2 material condition is substantially better, some improvements could still be made and continued emphasis on unit 1 and 2 is needed.

Plant Response/Action:

A preliminary analysis conducted by the plant revealed four decisive causes which led to the recommendation:

- Ageing installations ;
- Plant reference standards are not as stringent as international IAEA and ISO 14001 standards ;
- Cutting down on preventive maintenance ;
- Difficulties in performing maintenance during power operations.
- On the basis of this analysis, it was decided to take action in the following areas :
- Management ;
- Communication ;
- Maintenance ;
- Reference standards.

MANAGEMENT

For all outages scheduled to take place in 2003, an assistant to the outage manager is put in charge of the environment, plant condition and the Osart follow-up mission. With support from the quick minor-maintenance team, his task is to help identify and co-ordinate actions needing to be taken in conjunction with the departments, to restore compliance and rectify deficiencies.

As of 2003, outage project teams have undertaken to include equipment refurbishment in their schedule.

The decision to award credits on a multi-year basis for the refurbishment of plant installations and equipment, applicable for 2003 and 2004 is further evidence of commitment by plant management.

REFERENCE STANDARDS

Particular emphasis has been placed on housekeeping conditions and the quality of job-site close-outs, through the gradual introduction of start and end-of-work reports and job-site supervision. Each contractor supervisor drafts a supervisory procedure including job-site tidiness and plant condition.

In addition to actions aimed at increasing presence in the field, actions have been taken to raise EDF staff and contractor awareness of the need to take on board international standards.

Model areas are continuing to be brought up to current standards and inventories are carried out periodically.

COMMUNICATION

A number of meetings have been arranged with contractor staff. Special measures specific to outages with a reminder of plant expectations are systematically presented to them prior to outage. The issue relating to plant refurbishment was discussed at three forums attended by contractors hired for outages scheduled to take place in 2003.

The site video network is used to encourage immediate identification and correction of deficiencies and to highlight good practices.

Monthly meetings with management, frequent meetings between line-management and staff, and the drafting of department business plans provide a number of opportunities to communicate with staff and remind them of plant expectations.

During management meetings, the outage manager periodically reports on the progress of OSART recommendations, including the recommendation on the refurbishment of plant installations.

The training curriculum for contractor supervisors scheduled to work on outages in 2003 includes a module on ISO14001 and OSART follow-up expectations, including the recommendation on the refurbishment of plant installations.

MAINTENANCE

The process set up by the plant entailed establishing a system and tools for the immediate reporting of deficiencies identified during field inspections with input from line management, including formalised reports and more generally, for reporting all minor deficiencies detected in the field. As well as providing a means of tracking corrective actions, this process also makes it possible to monitor and improve the area's general material condition without having to do an in-depth analysis (cleaning, touching up paintwork, repairing heat insulation).

The power operations process, comprising all crafts, has been instrumental in improving the efficiency of maintenance.

The staffing of diagnostic teams per field of expertise also increases the level of responsiveness within cross-functional areas.

A cross-functional working group consisting of members from the operations, I&C/electrical and mechanical maintenance departments has been set up in order to eliminate shortcomings that hinder the normal workings of the process.

As part of the deliberate approach to reducing work-request backlogs, actions have been taken to help improve plant condition.

Indicators designed to track maintenance activities have been established in order to optimise the monitoring of :

- Maintenance departments' ability to plan and perform their work
- Percentage of level-1 work requests processed in a given month
- Work pending (delayed work requests and work orders)
- Work orders pending analysis

The following refurbishment work has been carried out:

- Repairs to heat insulation on secondary-system pipe-work in the turbine building.
- Repairs to or replacement of fire-fighting and drinking water pipe-work.

- Expert appraisal of secondary-system effluent release pipe-work, with refurbishment scheduled for the second half of 2003.
- Expert appraisal of gas storage pipe-work in the second half of 2003, with refurbishment scheduled for 2004.
- Refurbishment of oil stores in order to meet ISO 14001 standards.
- Repainting of all motor-driven pumps in the turbine building and pump house.
- Refurbishment of gas pressure-reducing stations.
- Refurbishment of seals on CVCS pumps.
- Refurbishment of handling equipment in order to bring it into line with statutory requirements.
- Refurbishment of seals on Fyrquel circuit.
- Refurbishment of fume hoods in chemistry lab.
- Refurbishment of thermal insulation and leak retention pans around superheated water pumps.
- Refurbishment and replacement of chilled water pipe-work.
- Refurbishment of walkways leading to turbine generator set intake valves.
- Refurbishment of filters on condenser tube bundle cleaning circuit.
- Replacement of air vents in nuclear auxiliary building scheduled over the period of 2002 to 2004.
- Various jobs associated with industrial safety, throughout the plant (floor mountings, walkways, access areas, protective casing, etc.).
- Refurbishment and labelling of turbine control cabinets.
- Refurbishment of drain channels in nuclear auxiliary building.
- Local and corporate modifications.

IAEA comments:

Material condition and housekeeping are treated as a single issue.

Operations Department has been assigned the responsibility of detection of deficiencies but all the organisation is involved too.

The 7 shift teams are responsible of 56 different areas and compare the condition of installations with some areas established as reference areas.

A dedicated team is responsible for minor maintenance and maintain backlog to a correct level. About 4000 deficiencies / year are handled by this team. Average time taken from detection to solution is less than 1 month. The personnel assigned by maintenance departments to this team change every 6 months, increasing awareness of staff about housekeeping standards.

Maintenance has reduced backlog by means of a diagnosis team working together with the operations shift, which repair or give additional information to reduce time to solve deficiencies.

The programme to improve Unit 3 to international standards will not be finished in 2003. An overall programme with suitable financial resources will be needed for Units 3 and 4.

Throughout the organisation there is better awareness of the importance to maintain condition status of the installations and the actions are clearly addressing the need to improve material condition.

The team encourages the plant to continue its efforts in this area.

Conclusion: Satisfactory progress to date.

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

The plant technical support (TS) organization consists of a core group of engineering specialists for analysing the performance of specific equipment such as valves, rotating machinery, instrumentation and control, and electrical. In addition methods engineers are assigned to each functional maintenance and operating organization. The TS staff were found to be very experienced and knowledgeable of the status and requirements in their subject area. For example, the valve engineer produces an annual report that provides highly detailed reviews of the contribution the different types and manufactures of valves in relation to plant costs and labour.

The number of staff providing technical support is sufficient to accomplish the required tasks to support safe operation.

The TS engineering organization has a line accountability through the assistant director of support to the plant director. The organization is reinforced by a large central engineering capability that manages the support of the entire EDF fleet of plants from central locations in Lyon, Paris and Marseille. There is good knowledge in the organization for the responsibilities and interfaces to support work in the plant.

The plant intends to change the reporting relationship of the engineering organization to become one of the advisory units to the plant director. This is being done to improve the ability of the engineering department to influence the other departments in the plant.

The powerful central support structure inherent in the EDF fleet concept provides both benefits and disadvantages. The benefits include the availability of very knowledgeable experts to bring to bear on large scale issue resolution and modifications. This allows the plant to focus its resources on safe day-to-day operation. The disadvantage of this concept is the time that it takes to install modifications given that these must be produced and installed in series for a whole line of similar plants.

The TS function at Tricastin NPP is effectively implemented for the majority of activities. However, during the course of the OSART visit, there was some indication of a willingness of staff to accept the status quo for longer term TS issues because the resolution request had been transferred to Lyon, Paris or Marseille.

The plant could not provide evidence during the review that sufficient technical support had been provided in some areas of generic engineering analysis such as seismic effect of temporary installed equipment and shielding and the behaviour of some reactor building materials following a Loss of Coolant Accident. The team made recommendations in this area.

5.2. SURVEILLANCE PROGRAMME

The surveillance test programme is specified centrally at the corporate engineering support unit and implemented at the plant. It is based on design and technical specification requirements. The plant departments that have the accountability for carrying out these tests also exercise the responsibility for producing the test procedures, implementing the tests and recording and analyzing the test results.

All tests are subjected to immediate first level checking and analysis to ensure that any deviations are managed in compliance with requirements and follow up checking and trending to predict and prevent degradation of safety margins.

Tests involving some critical parameters have been subjected to detailed risk analysis and special procedures have been produced to coordinate cross functional teams.

Good communication and feedback exists between the operation and maintenance functions during the planning and execution of the programme. Test procedures have clear cross-references to limits and acceptance criteria. The computerized work management system (SYGMA) is used for managing the periodicity and results of the test programmes in operations, maintenance and during outages.

Instrumentation and equipment used for surveillance testing is demonstrated to be accurate and regularly calibrated. This programme is managed by the maintenance department metrology section and supports the trending and analysis of the test results.

In two cases in the year 2000, test execution exceeded periodicity requirements. Corrective actions were taken following the second event, that have been effective in preventing further occurrences.

The surveillance programme is comprehensive, adequately documented and effective in ensuring the design requirements are met.

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

Operational feedback internal to the plant is managed by each functional department or advisory unit. Some departments have begun to create and collect information and trends on lower level events and precursors, however there is no common database for storage and trending of these, nor is there a common threshold for these events or precursors. The team suggested that improvement could be made in this area.

All departments process operational experience in compliance with site and corporate expectations. The operations department has a specialist devoted to the collection and distribution of events. On a weekly basis the shift operating team reviews both internal and external operating experience reports. This is effective in maintaining staff awareness of this information. EDF information focused on a specific evolution is provided as part of the pre-job briefing package to the operators executing the work.

Significant and reportable events are entered into the SAPHIR database for use in communicating feedback to the other plants in the EDF fleet. This data is also used by the central corporate engineering support organization to consider generic problems.

Two human performance consultants are in place at Tricastin NPP. They provide consultative support to individual departments when requested, review experience feedback on significant events when requested and provide training in human performance to a cross section of 30 staff volunteers from all site organizations. The plant has already trained 10 volunteers to assist in this effort, with another 8 presently undergoing training. The training combines classroom and practical experience and should be effective in improving the capability of individual departments to analyze and solve human performance issues. At this point, the two human performance experts do not perform an initial screening of all events. This would help to ensure consistency and thoroughness in the analysis of events. Although the plant performs root cause analysis of all significant events, in one case observed the corrective actions were neither

effective nor broad enough to prevent the inappropriate job site activities from reoccurrence. A recommendation was made by the team in this area.

5.4. PLANT MODIFICATION SYSTEM

Permanent plant modifications on safety related systems are produced and coordinated for the EDF fleet by the corporate engineering organization. This corporate organization provides the assurance that the modification meets all codes and standards, and that the plant will remain within its design basis after the modification.

The plant has responsibility for the production of modification packages on systems not related to safety. In all cases, the plant modification department translates the engineering documents into field execution packages and acts as project manager for the execution of this work. Modifications are installed in a series fashion across all applicable units in the EdF fleet, with enough time in between installations to incorporate experience feedback. The result of this is that the response time of corporate engineering to requests for modifications may be long as the package has to be created and introduced across the EDF fleet.

Modifications are effectively managed to ensure the necessary documentation is updated and training is complete prior to placing the modification in service, however, the team observed some open actions from modifications introduced in the outages for previous years.

Working files and permanent records of modifications are complete, thorough and up to date.

Temporary modifications have been installed to correct some design deficiencies primarily in the set points for alarm and process control. Some of these modifications have been in existence in all 4 units for several years with some greater than 10 years. There are no controls over the time limit these temporary modifications can be installed. A suggestion for improvement was made by the team in this area.

5.5. REACTOR ENGINEERING

Reactor physics and core management plans and studies are produced by corporate engineering organizations. The details of the reactor physics and core management are performed by computer codes and tools common to EDF. The analysis and documentation produced by these groups is thorough and comprehensive.

Core loading plans produced by the corporate engineering organization are checked by the fuel manufacturer and then validated using an in depth quality assessment.

Reactor physics surveillance tests carried out during start-ups are proceduralized and executed by the plant operations and maintenance testing organizations. These procedures are of high quality and are reviewed by the central engineering organization. However, mark-ups and corrections during the execution of these procedures were not required to be individually initialled and dated. Representatives of the corporate engineering organization are present throughout these start-up tests to act as consultants and technical advisors. This practice ensures independent quality assurance of the testing process.

Fuel defect monitoring is carried out by the plant chemistry department according to requirements and is executed within normal expectations.

5.6. FUEL HANDLING

The central nuclear services department (GNU) carries out fuel handling operations at the plant. Handling and storage of fuel includes special provisions for the MOX fuel used at Tricastin NPP. This process is performed within normal expectations.

Water condition in the spent fuel pools is satisfactory. There is a painting and coating programme for the floor and walls of the fuel buildings and it has been successful in improving the material condition of the facility.

Tools and procedures used in this process are in good condition. During review of the spent fuel pools and the Unit 3 fuel pool and reactor cavity, deficiencies in the foreign material exclusion process were observed and are reported in the maintenance section of this report.

5.7. COMPUTER APPLICATIONS IMPORTANT FOR SAFETY

Plant process computers are effectively managed using accepted configuration control practices. Modifications are produced offline and then installed in the plant computers. A post installation validation process is executed effectively.

The plant I&C maintenance department provides initial maintenance response. A comprehensive manufacturer support programme ensures the availability of spares and provides quick turnaround for returning equipment to service.

Obsolescence issues for the computer equipment are addressed effectively by the EDF central organization for computer support.

The plant process computer organization maintains a local copy of the software files, with backups located in Marseille. It was observed that the local copy of the files is not stored in fireproof filing cabinets and there is not a documented or practiced disaster recovery plan.

STATUS AT OSART FOLLOW-UP VISIT

In the Technical Support area, Tricastin NPP has resolved one recommendation and one suggestion. The plant is making satisfactory progress on the remaining two recommendations and one suggestion.

Since the time of the OSART mission, the role of site engineering has been enhanced. In addition to the issues usually addressed (technical contribution to operations meetings (RTE), coordination of corporate technical files, etc.), Tricastin has invested considerable efforts into developing their own expert appraisal sheets (54 in 2003), with an investigation carried out at the request of the relevant plant departments. Some examples include the analysis of wear on Conventional Island Closed Cooling exchanger tubes, and the availability of emergency diesel generators depending on outlet temperature.

Tricastin NPP has two engineers from the design organization now assisting at the site. One of these engineers is dedicated solely to Tricastin and works with issues related to the primary plant; the other deals with design issues from the secondary side and works at all four Rhône Valley plants. Design questions are brought to these engineers by plant personnel. Simple questions are answered directly by the engineers; more complex questions are referred to the corporate design organizations. This system provides the plant with a direct means to have questions concerning the design answered.

The question of thermal insulation in the reactor building fragmenting and blocking suction strainers continues to be a question for PWR plants around the world. Intensive research and analysis is being performed on this issue. In fact, the French regulator has asked EDF to accelerate its analysis of the issue and, if actions are necessary, implement those actions. While this issue is not resolved, the present focus on the problem should lead to timely action.

The plant has reviewed the mechanical loading of cable trays and identified the most heavily loaded trays. These loadings have been compared with that allowable in the original design and found to be satisfactory. In addition, the plant has embarked on a programme to repair trays that have been damaged over time. Extensive repair or replacement of cable trays has been done throughout the plant, including the areas mentioned in the OSART report.

Based on corporate analysis and guidance, Tricastin has developed its own simple guidelines for controlling seismic risks. These guidelines have been included in the booklets for workers and contractors. Reference standards have been prepared which include the guidelines along with pictures of installations in the plant. A tour of the plant confirmed that scaffolding and tools in the vicinity of seismic equipment are well controlled. Biological shielding to protect workers from radiation have been significantly upgraded. In many places temporary lead shielding has been replaced by steel plates fabricated for the specific application and seismically restrained. Where temporary lead shielding is still required, it is firmly attached to a seismically restrained frame.

Tricastin has clarified the requirements surrounding temporary modifications and enhanced the monitoring in this area. Nine clear rules have been identified based on existing requirements. These rules are communicated to those developing or installing temporary modifications in the plant. Through these rules, the plant specifies when it is appropriate to install a temporary modification and controls the quality of the installation. Additional management effort has been directed to limiting the number of temporary modifications.

Tricastin NPP has integrated Human Performance (HP) aspects into event analysis. There is a coordinator assigned for each reportable event that leads the analysis. There is a group of trained HP experts who make up a network to assist the HP consultant in analysing and reviewing events. And a second human performance consultant is being added. Procedures employ clear methodologies for the analysis. At this point the programme appears to be effective, and the plant is encouraged to maintain the focus it has placed on implementing this programme. The team believes that with continued management attention the present programme will provide a valuable tool for continuous improvement.

The Tricastin NPP has developed a software system to record and characterize low level events or anomalies. This software system appears to be a good tool for documenting events and categorizing those things that may have influenced the occurrence of the event.

At the time of the follow-up visit, only about one hundred and fifty low levels events or anomalies had been entered in the system. While several departments had agreed to enter information in the system in 2004, negotiations with other department to begin entry are still ongoing. Because of the limited data available in the system, analysis and trending had not been started.

The team encourages the plant to move forward with this programme so that the full benefit of the low level event reporting and analysis programme can be realized.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1. ORGANIZATION AND FUNCTIONS

5.1(1) Issue: Engineering support activities do not always provide sufficient demonstrable analysis to give assurance that the installed systems can meet their design intent under all conditions.

Supporting Evidence:

- During the OSART review, the plant could not provide sufficient evidence that the thermal insulation being installed in the Unit 3 reactor building had been reviewed for impact on the clogging of emergency coolant injection and recovery strainers following a Loss of Coolant Accident. International experience is that this review needs to be done since the type of insulation being used has been shown to have the potential to block strainers.
- Cable trays are heavily loaded in many plant areas. One cable tray was observed to be deformed. Although this problem has been recognized and some review and repair work has been performed, an engineering analysis has not yet been performed to consider the consequences of this heavy loading with respect to insulation damage, overheating fire loading, seismic effect and the ability to troubleshoot and replace.
- Some equipment and material was found located adjacent to seismically qualified systems. The plant could not demonstrate that the potential to damage or render these systems unavailable during an earthquake had been addressed. Examples include heavy breaker tooling temporarily placed near a seismically qualified breaker and temporary lead shielding.

Without a thorough engineering analysis for all deficiencies and equipment conditions, some systems may not be available when required to support plant safety under all conditions.

Recommendation: The plant should establish that there is sufficient analysis to demonstrate that the installed systems meet their design intent under all conditions. These analyses should include:

- Detailed engineering review and design requirement for the type of insulation used and the installation standards for reactor building piping thermal insulation taking into account the post-LOCA strainer blocking information available in the industry.
- An engineering review of temporary placement of equipment for affect on nearby seismically qualified equipment.
- A comprehensive review of all cable trays for loading that may cause insulation damage, overheating, fire loading, seismic effect and ability to troubleshoot and replace.
- In the absence of such analysis and review, mitigating operational actions could be put in place until the analysis is performed.

Plant Response/Action:

Right from the time its plants were initially designed, EDF – which has the distinguishing feature of being both designer and operator – has provided design studies demonstrating that all installed systems (safety-related systems in particular) are able to fulfil their intended functions.

The main conclusions of these studies are written up in safety analysis reports (preliminary, provisional and final), which are submitted for review and approval to the Regulatory Authority when applying for permission to construct and commission a plant.

Safety reference standards may be upgraded on the occasion of specific ten-yearly safety reviews or following meetings held by the Standing Committee of experts for Reactors. As a result, studies are updated to incorporate changing standards and changing methods, and to update safety analysis reports.

With regard to the individual points raised by the OSART team (heat insulation, cable trays, seismic effect), more specific details discussed below show that these analyses were indeed carried out with the aim of guaranteeing the functionality of the various systems concerned.

In more general terms, the organisational structure of EDF is based on a standardised nuclear fleet and a centralised engineering structure which does not reside on the sites.

In the past few years however, EDF has highlighted the need for its design engineering resources to become actively involved in addressing challenges faced by its plants. In order to fulfil this need, the PISP project was set up in 2001. Since October 2001, two design engineers have been seconded to Tricastin NPP (and to the 19 other EDF nuclear power plants). One engineer is put in charge of the nuclear parts of the installation while the other is put in charge of the conventional side. Their presence provides the plant with :

- Access to the design reference base;
- Engineering support on site, fulfilling an operational function;
- A guarantee of responsiveness from the designer;
- An opportunity to discuss operational challenges and associated priorities with the designer.

Examples : When dealing with the problem of component-cooling pump trips during certain phases of operation, the designer was able to provide Tricastin NPP with the findings of an investigation conducted on behalf of another plant. The engineers were closely involved during inspections, when design-related topics were discussed.

SPECIFIC DETAILS:

HEAT INSULATION

The operating event that occurred at the Barsebaeck plant (600MW BWR – Sweden) on 28/7/1992 was analysed by EDF in 1992. An experience-feedback document tracks the way in which feedback from this event was processed by EDF (during start-up operations, the spurious opening of a primary-circuit safety valve caused heat insulation to come off some pipe-work. The containment-spray system came into use due to the steam leak. About two hours later, cavitation was observed on these pumps

as thermal insulation that was carried along by containment spray had clogged the sump strainers.).

In view of its sensitive nature, this issue was raised a number of times by the regulatory authority, for example at a meeting of the standing OEF committee 90/93. This information, combined with a draft of a generic letter from the NRC (GL 98-04 published on 14/7/98) led EDF to initiate a corporate analysis on 27/10/1997 regarding potential risks during the safety- injection/containment-spray recirculation phase (AnP97016). The objectives of this analysis were to:

1. Identify and quantify the debris produced during LOCA and carried towards safety injection/containment-spray sump strainers during recirculation.
2. Decide upon the mechanical strength of safety-injection/containment-spray sump strainers during recirculation.
3. Review the impact of debris produced during LOCA on the functionality of safety injection/containment-spray equipment and define potential modifications
4. Ensure consistency of work hypotheses and methods adopted for implementing the various actions.

Following a design review of the safety-injection system which took place in December 1997, the corporate analysis was closed and the studies were incorporated into points 2.2.3.a and b of CCE 1190 (technical committee findings) :

2.2.3: Problems caused by accumulation of heat insulation on reactor building sump strainers in the event of a LOCA.

- a) Assessment of pressure drop and NPSH of low-pressure safety-injection pumps.
- b) Mechanical strength of strainers.

These studies, based on the design reference base (NUREG897 Rev. 1, 1982), were completed in 2001 via a response sheet addressed to the regulatory authority (letter D4008-27-edf/CF-08-033, 4/9/2001) and the associated procedure no. EMEFC00.0097A. They reveal that the clogging of safety-injection/containment-spray sump strainers following LOCA would not affect recirculation. This information was given to the IAEA experts during the OSART mission in January 2002.

The file submitted to the regulatory authority is being reviewed by the IRSN/DES on the basis of the design reference documents. At the same time, the French Regulatory Authority (DGSNR) has asked the IRSN/DES to assess the impact of developments in international practices on these documents (meeting between EDF/and the regulator on 10/4/2002). Indeed, the findings of recent studies conducted in the USA or currently being conducted in France on the subject of heat insulation behaviour, could potentially result in a review of safety-injection/containment-spray sump design criteria. Further analysis is required for possible inclusion in the third ten-year VD3 outage schedule (see correspondence from Dupraz on VD3 no. IB 02/50, dated 10/09/2002).

For information purposes, engineering case file No. AI01-09 (safety-injection/containment-spray functionality) was opened on 24/4/02 (procedure EMESC020173A, 29/05/02). It aims to co-ordinate the remaining studies demonstrating the functionality of existing safety-injection and containment spray sump strainers in the event of LOCA and in the presence of a large amount of heat

insulation debris (studies carried out for the 900MW plant series were completed in 09/01).

SEISMIC EVENT RISK ASSESMENT

An operational “seismic event risk assesment” guide has been produced. Drafted as part of the effort to protect against seismic risk, the guide provides workers with simple and practical rules for the installation of shielding and scaffolding as well as simple rules regarding mobile equipment in control rooms and electrical rooms.

In the near future, a page will be added to the worker’s industrial safety booklet, reminding workers:

- to not overload safety-related structures or equipment without a preliminary analysis, and if they are obliged to do so, to use autonomous supports,
- to attach mobile equipment liable to topple or slide onto sensitive equipment.

These documents were presented to the department most affected by this issue, i.e. the nuclear fuel and general services department (GNU), which is in charge of installing shielding and scaffolding structures. This department has undertaken to include these requirements in its risk assessment and undertakes to enforce these principles. The GNU is currently assimilating the associated rules in order to incorporate them into risk assessments and work packages. The technical advisory group is providing assistance and advice to support this initiative.

The basic rules presented above are also distributed to contractors at meetings held prior to outage.

Lastly, a programme is underway to replace some permanent shielding in the nuclear auxiliary buildings. This programme includes earthquake resistance checks. Some shielding is currently being installed. In the most complex instances (REN heat exchangers), we have requested support from the corporate engineering structure (CIPN).

CABLE TRAYS

All issues relating to heavily-loaded cable trays have been analysed from the following perspectives :

- earthquake resistance ;
- cable overheating ;
- fire loading.

EARTHQUAKE RESISTANCE

During an inspection of Tricastin plant on 01/08/02, overloaded cable trays were itemised. We extracted the linear loads of the incriminating trays from the cables file. The tray with the heaviest load was tray no. 1L6033C/F in room no. 1L607, with 86.3 kg/m.

This enquiry shows that even in the event of volume overload, technical specifications stipulating a linear load of less than 100 kg/m on 500-mm trays have been complied with.

Disused cables are listed in the cables file. Checks have been carried out with all cables present in the trays, including disused cables.

CABLE OVERHEATING

Cable overheating is due to losses, caused by the Joule effect, that are proportional to the square of the current passing through. Overloaded trays are those which are used for ‘measurement’ cables, ‘instrumentation and control’ cables or ‘low-voltage’ cables.

Where ‘measurement’ and ‘instrumentation and control’ trays are concerned, there is no overheating risk because of the very low current passing through instrumentation and control cables.

In the case of low-voltage cable trays, the cable section is determined by calculating the smallest standardised section which simultaneously meets the following three criteria :

- Normal heating,
- Voltage drop,
- Overload due to short-circuit.

Taking into account LV cable design methods, it was confirmed that a reduction in air contact surface caused by a volume overload did not result in excessive overheating of LV cables.

FIRE LOADING

Overloading of cable trays does not have an impact on fire loading. Indeed, the calorific value of a room is determined on the basis of the actual number of cables routed through the room. Design calculations have indeed confirmed that actual fire load density includes disused cables.

REPAIRS TO DAMAGED CABLE TRAYS

The OSART team observed collapsed cable trays in some areas of the plant. This damage was due to a lack of respect for plant installations during maintenance work and not to overloading. Major refurbishment work was carried out on cable trays, with more than 1000 meters being repaired in 2002.

IAEA comments:

Since the time of the OSART mission, the role of site engineering has been enhanced. In addition to the issues usually addressed (technical contribution to operations meetings (RTE), coordination of corporate technical files, etc.), Tricastin has invested considerable efforts into developing their own expert appraisal sheets (54 in 2003), with an investigation carried out at the request of the relevant plant departments. Some examples include the analysis of wear on Conventional Island Closed Cooling exchanger tubes, and the availability of emergency diesel generators depending on outlet temperature.

Tricastin NPP now has two engineers from the design organization assisting at the site. One of these engineers is dedicated to issues related to the primary plant; the other deals with design issues from the secondary side for the four Rhône Valley plants. Design questions are brought to these engineers by plant personnel. Simple

questions are answered directly by the engineer; more complex questions are referred to the corporate design organizations. This system provides the plant with a direct means to have questions concerning the design answered.

For the specific points raised during the OSART mission:

- The question of thermal insulation in the reactor building fragmenting and blocking suction strainers continues to be a question for PWR plants around the world. Intensive research and analysis is being performed on this issue. In fact, the French regulator has asked EDF to accelerate its analysis of the issue and, if actions are necessary, implement those actions. While this issue is not resolved, the present focus on the problem should lead to timely action.
- The plant has reviewed the mechanical loading of cable trays and identified the most heavily loaded trays. These loadings have been compared with that allowable in the original design and found to be satisfactory are included in the review process for modifications to ensure that the addition of new cables will not exceed allowable values. In addition, the plant has embarked on a programme to repair trays that have been damaged over time. Extensive repair or replacement of cable trays has been done throughout the plant, including the areas mentioned in the OSART report. A tour of the plant confirmed the good quality of the cable tray installation and repair. This specific example has been resolved by the plant. Likewise the concerns over heating and fireloading in cable trays have been analyzed and shown to be acceptable.
- Based on corporate analysis and guidance, Tricastin has developed its own simple guidelines for controlling seismic risks. These guidelines have been included in the booklets for workers and contractors. Reference standards have been prepared which include the guidelines along with pictures installations in the plant. A tour of the plant confirmed that scaffolding and tools in the vicinity of seismic equipment are well controlled. Biological shielding to protect workers from radiation have been significantly upgraded. In many places, temporary lead shielding has been replaced by steel plates fabricated for the specific application and seismically restrained. Where temporary lead shielding is still required, it is firmly attached to a seismically restrained frame. This specific example has been resolved by the plant

Conclusion: Satisfactory progress to date

5.2(2) Issue: The control of temporary biological shielding is not sufficient to ensure that shielding is installed in a manner which assures it will accomplish its intended radiological function without adversely impacting other components, systems, areas, etc.

Temporary biological shielding was noted, on several occasions in Unit 3, to be installed directly onto pipes without an analysis of the structural effects that could result from its installation.

A large amount of temporary biological shielding is stored in Unit 3 without control.

Temporary biological shielding was installed by contractors directly onto steam generator piping in Unit 3 in quantities that complied with their “professional judgment” as opposed to any engineering analyses.

Temporary biological shielding on wheels was installed (Unit 4, Room K-216) without having been assessed by the technical support organization for its long-term benefit or its potential for being incorporated into a permanent plant modification package.

The improper control and installation of temporary biological shielding could result in its inability to provide the protection for which it was intended, and could result in the structural failure of equipment and systems with which it interacts.

Recommendation: Plant management should establish controls sufficient to ensure temporary biological shielding receives adequate analysis to assure that the shielding will accomplish its radiological function without adversely impacting other systems or components. In particular, analysis should be done for lead shielding hung on piping.

Plant Response/Action:

In response to the need for analysis regarding the installation of shielding, investigations aimed at improving our management of this aspect focused mainly on the practical implementation of the respective policy. As part of this effort, two specific documents were drafted :

- An operational “seismic event risk assesment” guide which includes a specific paragraph on shielding and specifies applicable rules, i.e.:
 - Do not use safety-related equipment supports in order to attach shielding;
 - Do not overload safety-related equipment with shielding;
 - Preventive measures must be taken if the distance between the structure and the piece of safety-related equipment is less than 1 m, or if the structure might topple over onto the piece of equipment.
- Technical memorandum (points of policy governing shielding), which specifies potential damage to equipment caused by shielding structures, and describes the requisite preliminary analysis (ALARA) prior to installing this shielding:
 - First and foremost, try to eliminate the source;
 - Divert passageways.

These two documents also specify that the technical advisory group may be called upon to provide support as part of its advisory function.

These documents were submitted to the Extended Plant Management Committee (with all department managers in attendance) and more particularly to the nuclear fuel and general services department manager, who co-ordinates the adoption of these rules.

Lastly, the technical advisory group's radiation protection specialist regularly carries out field inspections during outage in order to check that the above-mentioned rules are adhered to.

IAEA comments:

As discussed in the comment following issue 5.1(1), Tricastin has developed its own simple guidelines for controlling seismic risks. The guidelines are based on corporate analysis and guidance. These guidelines, along with pictures of installations in the plant, have been included in the booklets for workers and contractors. And communication to workers is provided. A tour of the plant confirmed that scaffolding, placement of temporary lead shielding, and tools in the vicinity of seismic equipment are well controlled. Biological shielding to protect workers from radiation have been significantly upgraded. In many places, temporary lead shielding has been replaced by steel plates fabricated for the specific application and seismically restrained. These designs have been validated by the Radiation Protection (RP) engineer. Where temporary lead shielding is still required, it is firmly attached to a seismically restrained frame. Clearly the plant has invested extensive effort in resolving this issue. The work done by Tricastin to provide seismically restrained shielding is a model for other plants.

Conclusion: Issue resolved

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

5.3(1) Issue: There are weaknesses in the analysis and implementation of corrective actions for events related to inadequate work site conditions and activities, including human performance activities.

- Following a generator trip caused by foreign material, recommendations were made to improve the Foreign Material Exclusion (FME) practices for generator work only. FME practices continue to be deficient in the generator work and other important areas. Examples are turbine overhaul and the spent fuel pools. (Note that details of the deficiencies of FME practices are discussed in the Maintenance section of this report).
- During the OSART mission a personal dosimeter was dropped into the fuel pool.
- Safety related instrument tubing was installed with the tubing in contact. Subsequent rubbing has caused wear on the tubing. No analysis of this condition has been performed.
- Although there are human performances experts at the site, and a cross section of staff are being trained in human performance analysis techniques, not all events are subjected to an initial screening for human performance. An example is the reportable event of July 13th, 2001 where the plant start-up was begun without lubrication supply to one of the turbine bearings. This event was not subjected to human performance analysis.

Work site events that are not thoroughly analysed for the root causes and corrective actions that are not implemented or insufficiently comprehensive increase the probability of safety and production significant events.

Recommendation: The plant should strengthening their analyses of work sites and work site related events, including human performance activities, in a proactive way and implement sufficient preventive actions in affected work sites activities.

Plant Response/Action:

For the past few years, we have already been factoring human performance into our event-analysis process. In concrete terms, this is demonstrated by the following activities :

- Department HP representatives and/or the HP consultant are directly involved in the analysis of some events, without the nature of the event in question (HP-related and organisational) being specified.
- The HP branch of the safety/quality advisory group takes part in the analysis of event reports within a reading group, prior to their validation by the GTS committee.
- The HP branch of the SQ advisory group is a member of the GTS and GTR committees.

In 2002, a process-based co-ordination system was introduced at Tricastin NPP. Processes include that of ‘operational safety’ which, among other things, entails the development of a HP culture. In this respect, a formal structure has been established,

defining the sequence of stages making up an event analysis with a human and organisational dimension. The process consists of the following phases :

- Selection of significant operating events with a human and organisational dimension
 - This selection is based on corporate criteria drawn up in line with the new method of characterising HP causes leading to significant operating events.
 - These criteria also factor in local experience feedback.
- Selection of committees and participants deciding on human-performance factors of the event
 - The HP branch of the SQ advisory unit is systematically consulted.
 - All events (safety-significant, RP-significant, transport events, environmentally significant) are analysed to determine their nature.
 - A system still needs to be devised in the event of disagreement on the type of event.
- Selection of participants involved in event analysis
 - In the case of more serious events, the HP branch of the safety/quality advisory group provides support to the analysis co-ordinator.
 - For other events, it is the department HP representatives or team representatives who provide support to the analysis co-ordinator.
 - For some cross-functional events, HP representatives from the departments concerned get in touch with each other in order to work together.
 - The HP branch of the safety/quality advisory group independently tracks the analysis.
- Defining a methodology for implementing the HP approach to event analysis

The HP approach to event analysis is a collective one. It is the best way of ensuring that all those involved take OEF on board:

- In the instance of an HP-related and organisational event, the analysis co-ordinator requests support from the appropriate HP representative or the HP branch of the safety/quality advisory group, depending on the case.
- The analysis co-ordinator provides the HP specialist with the necessary documents.
- The co-ordinator calls upon the HP specialist's skills during interviews, in order to establish what actually happened and jointly build up a sequence of causes.

This process forms part of a more general effort to improve experience feedback management at the plant.

SPECIFIC DETAILS:

TUBING

Following observations issued by the IAEA experts, we carried out a general investigation on instrument tubing. The investigation came up with the following findings :

- With regard to instrument tubing installations, there are no reference criteria for their design or manufacture. Tubing is installed on the plant in accordance with professional practices, leaving spaces between tubing installations or between tubing installations and support structures.
- Experience feedback from other EDF plants does not reveal any problems caused by the wearing of tubing due to friction.
- Identified deficiencies are essentially the result of accidental deformation after construction (probably during maintenance work in the areas concerned).

Given the amount of tubing installed on the plant, an exhaustive and immediate check is not feasible. However, it has been decided that a check would be systematically performed during sensor inspections in the field, carried out by the I&C/electrical and data-processing department. Any deficiencies detected on these occasions will then undergo a specific analysis.

QUALITY OF MAINTENANCE WORK

Lastly, the plant has been gradually introducing the pre-job briefings and fine-tuning its risk-assessment methods (see response to recommendation no. 1.2(2)), the aim of which is also to improve the quality of maintenance work.

IAEA comments:

Tricastin NPP has integrated a systematic assessment of Human Performance (HP) aspects into event analysis. There is a coordinator assigned for each reportable event. There is a group of trained HP experts who make up a network to assist the HP consultant in analysing and reviewing events. A second Human performance consultant with extensive knowledge of the plant will soon join the present HP consultant. Procedures employ clear methodologies for the analysis.

At this point the HP analysis and the integration of analysis results into the yearly safety analysis report and mid-term business plan appears to be effective. Since Tricastin has only eighteen months experience, the plant is encouraged to maintain the focus it has recently placed in implementing this programme. The team believes that with continued management attention the present programme will provide a valuable tool for continuous improvement.

Conclusion: Satisfactory progress to date

5.3(2) Issue: Although the plant has started to increase the reporting of low-level events, there is not a common system, threshold or database to collect and analyse these events. This issue has been identified in OSART reviews at several other EDF plants in EDF.

The threshold is defined at the corporate level for significant events affecting safety only and there is no corporate directive for low level reporting.

The following are examples of items not recorded in a common database of precursors, some are not reported and others are reported in separate databases:

- Procedure deficiencies.
- Valve isolations and tagging errors
- Maintenance rework.
- Improper radiological practices.
- Poor industrial safety practices and minor accidents.
- Industrial safety hazards.

The lack of a systematic approach to low level event reporting impacts the amount of information available for trending of problems. Root cause analysis of these precursor events is therefore not performed to identify appropriate improvements and to validate the effectiveness of current action plans. This would help identify precursors to prevent more significant events from happening

Suggestion: The plant should consider continuing with the effort to increase low level event reporting and should consider the use of a common database for the recording, review and analysis of these events.

Plant Response/Action:

This suggestion reinforced the argument for taking action at a local level, in view of the fact that EDF Senior Management was already aware of this issue.

A project group was therefore formed in order to devise a process for collecting, analysing and processing lower-level events as well as failures, anomalies and deficiencies not qualifying as deviations from a standard.

This project group, headed up by the HP consultant from the safety/quality advisory group and the plant OEF co-ordinator, set itself the task of creating an additional tool designed to supplement (but not replace) those already used by Tricastin NPP and other French plants. It would be used to :

- analyse trends emerging from the characterisation of facts which, in isolation, do not necessarily affect performance (operational safety, environment, radiation protection, industrial safety, quality), but which, when recurring, accumulating or occurring simultaneously, could lead to more serious events.
- generate experience feedback as events occur, by providing plant staff with a database containing a history of facts.

The working method used to set up the process and produce the data collection

software comprised a series of parallel phases:

Processing of existing off-site experience

- Looking at international practices regarding low-level events, such as the British and American approach of blame-free error reporting.
- Looking at accident analyses in high-risk industries (e.g. Diane Vaughan's analysis of the Challenger disaster).
- In-house EDF benchmarking: Exchanges with Golfech NPP.
- Processing of existing on-site experience
- Analysis of plant practices and structures, highlighting a multitude of tools and systems, unrecorded shortcomings and a lack of overall analysis.

On the basis of this diagnosis, the process was set up with the following objectives :

- Develop a cross-functional overview of experience feedback (all areas)
- Analyse trends emerging from the characterisation of facts, in order to assess potential escalation
- Suggest working strategies in terms of targeted analyses and/or vectors of progress.

The schedule for the production of the software package, which drew on the plant's IT resources right from the outset, proceeded as follows :

- Preliminary development of collection functions consistent with the new characterisation of EDF events and subject to the approval of future users,
- Drafting of specifications, submitted to the plant's information systems committee and approved by the senior management team,
- Programme development (collection phase)
- Method and software programme presented to groups and individuals concerned: Industrial Safety Committee, HP network, safety/quality advisory group.
- Software made available to a few targeted users for trial purposes: HP, ISO, OEF, industrial safety and safety/quality.

STATUS AT END OF SEPTEMBER 2003

By this date, the data collection programme was ready for use and had been approved by the various department representatives. In the short term, collection functions still need to be finalised, while screening and retrieval functions still need to be created.

The plant's overall objective is to have a fully operational tool by the end of the year, as well as a permanent organisational structure to back it up. In the medium term, the following actions have to be taken :

- Finalise screening and retrieval functions,
- Process experience feedback from programme users since the month of April,
- Gradually make the programme available to appointed users within the departments,
- Perform initial analyses on the basis of available data.

IAEA comments:

The Tricastin NPP has developed the SILEX software system to record and characterize low-level events or anomalies. This programme uses a series of pop up screens which ensures consistent entry of information. Entering information in this way enhances the ease of performing analysis and trending of the low level events. This software system appears to be a good tool for documenting events and categorizing those things that may have influenced the occurrence of the event.

Normally plants collect several hundred low-level events or anomalies each year. With this number, the plant is able to see the statistically significant factors influencing low-level events. At the time of the follow-up visit, only about one hundred and fifty low levels events or anomalies had been entered in the system. While several departments had agreed to enter information in the system in 2004, negotiations with other departments to begin entry are still ongoing. Because of the limited data available in the system, analysis and trending had not been started.

The team encourages the plant to move forward with this programme so that the full benefit of the low-level event reporting and analysis programme can be realized.

Conclusion: Satisfactory progress to date

5.4. PLANT MODIFICATION SYSTEM

5.4(1) Issue: The plant does not control the length of time that temporary modifications are installed. Some temporary modifications installed in the operating systems have been there for several years with some greater than 10 years old. The team observed the following:

- Temporary modifications involving the pressure control set point for the H2 tank on the RCV system have been in place for greater than 10 years on all units.
- Temporary modification dated 19/04/1999 on OSDX151AB on the control of pH in the neutralizing tanks.
- The plant has recognized this issue and has instituted risk analysis for all temporary modifications. As well, some progress has been made in the conversion of temporary modifications on non-safety related systems to permanent modifications, however installation of permanent modifications on safety related systems requires support and review from the central nuclear engineering department with its inherent long time requirements.
- Some plant documentation connected with temporary modifications will not be updated until a permanent modification is produced. The engineering review for temporary modifications is not as thorough and comprehensive as for the permanent modifications.

This lower level of review and support increases the probability of a loss of configuration control, and creates the potential for the installation of an inappropriate change to a safety related system.

Suggestion: The plant should consider establishing controls for the length of time that temporary modifications are installed. As part of these controls, the plant should consider performing in-house engineering reviews and documentation updates equivalent to permanent modifications on temporary modifications exceeding a specified installation time.

Plant Response/Action:

Based on the findings of the IAEA team during the OSART mission, the plant has decided to follow two main courses of action :

- Reduce the number of temporary modifications by compiling local modification packages and managing specific control-channel settings on non-safety-related equipment in SYGMA and removing associated temporary modifications;
- Improving the process used to manage temporary modifications.

This strategy was approved by the Operations Technical Committee and a person has been appointed to implement it.

Temporary modifications are trended (indicators) once a month on the basis of two criteria: number of modifications and date of installation. A six-monthly report is submitted to the Operations Technical Committee by a maintenance department engineer and a member of the operations support team.

Between June 2002 and June 2003, the number of temporary modifications installed prior to 2002 fell from 116 to 42. An analysis of the remaining temporary modifications was carried out and for each of these a decision was taken and approved by the Operations Technical Committee on July 3rd 2003.

As part of the effort to improve the process used to manage temporary modifications, a working group was convened to make proposals. Its findings were approved in July 2003. They specify the definitions and requisite criteria for the installation and removal of a temporary modification, as well as the roles and responsibilities of the various people involved in the process.

IAEA comments:

Tricastin has clarified the requirements surrounding temporary modifications and enhanced the monitoring in this area. Nine clear rules have been identified based on existing requirements. These rules are communicated to those developing or installing temporary modifications in the plant. Through these rules, the plant specifies when it is appropriate to install a temporary modification and controls the quality of the installation.

Additional management effort has been directed to limiting the number of temporary modifications. Temporary modifications are clearly identified, and classified by type. Removal of the temporary modification in a timely manner is closely monitored through monthly trending and a semi-annual report to the Operations Technical Committee. Particular attention is paid to the number of modifications and the date of installation. Many temporary modifications have been converted to local modification packages. Non-safety instrument set-points are no longer controlled through the temporary modification system, but through SYGMA.

Although the team considers the issue resolved, the plant acknowledges that continued management attention is warranted to prevent the number of temporary modifications from growing again.

Conclusion : Issue resolved

6. RADIATION PROTECTION

6.1. ORGANIZATION AND FUNCTIONS

Responsibilities in the area of Radiation Protection (RP) are distributed throughout the various organizations that work at the site. This includes the RP department, other Tricastin organizations (e.g. Operations, Chemistry, and Nuclear Logistics), and the various contractors that support plant activities. Additionally, at Tricastin NPP, the industrial safety and medical responsibilities associated with the protection of workers are consolidated under the Radiation Protection department. This has resulted in the development of broad directives that provide guidance for assuring the overall safety of workers. The responsibility for the implementation of these directives rests with the individual work site supervisors, a process that is generally understood by all personnel.

The RP department has developed numerous indicators for tracking and assessing performance. These indicators primarily address issues associated with their compliance with regulatory requirements and, therefore, focus on long-term considerations. They provide management with insights sufficient to identify and correct performance deficiencies. Outlier data is analyzed and assessed and the lessons learned are incorporated into the site's experience feedback process.

The RP department is staffed with ~ 45 technicians. They are assigned to one of two branches, responsible for either operational applications or policy and procedure development. While these numbers may seem low for a 4 Unit site, work activities are mostly contracted and each contractor (and the individual work site supervisor) is responsible for the establishment, implementation and oversight of radiation protection activities; effectively, this supplements the RP staff with an RP presence at each work site.

In 1999, there was a significant irradiation event, which occurred at the site. This event provided an incentive for substantial improvement initiatives in the RP area. As an outgrowth of this push for improvement, the Tricastin NPP staff has assumed a leadership role in developing and piloting many RP improvements. Examples include the development of tracking software to manage preventive and corrective maintenance activities on radiation protection instruments, and the identification and procurement of Commercial-Off-The-Shelf (COTS) industrial type cases (type A) for transporting sources, both internally and externally to the plant.

Overall, the training and qualifications of the RP staff are acceptable. Radiation protection training for contractors is accomplished by nationally certified institutes and the plant staff provides site-specific information. Tricastin staff are co-trained by the on-site training and RP departments. Operational experience feedback is consistently provided through refresher training and through a weekly Health and Safety meeting with all contractors.

6.2 RADIATION WORK CONTROL

The control of radiological work at Tricastin NPP is being accomplished in an effective manner that assures the overall health and safety of plant personnel. Work planning is a cooperative effort between the EDF department that orders the work activity; the contractor, who is responsible for all aspects of personnel safety on the job site; and the RP department, which provides overall oversight of personnel safety practices on the site.

Each work site contractor, with guidance from the ordering EDF department, must develop a risk assessment plan that addresses all of the potential worker safety issues for the particular job. The work site supervisor is legally responsible for the implementation of this plan and includes assuring that appropriate radiological protection measures are present. Pre-job planning and orientation are required and are conducted a few days prior to the commencement of the overall work activity and immediately prior to each work task.

Because of the contractor's safety responsibility, the RP department does not have to provide the on-the-spot controls at every work location within the Radiological Controlled Area (RCA); instead, they appropriately define the different areas inside the RCA (green, yellow, orange, red), and oversee the contractor's compliance with national and site directives. RP personnel do provide the direct support needed for EDF-performed job activities and provide consultation services to a contractor, if specially requested. This decentralization of the direct oversight responsibility has resulted in some consistency challenges.

During the review, it was noted that Radiation Worker practices were not being consistently adhered to and implemented. Workers were not appropriately attentive to the details associated with the controls and procedures that have been put in place by EDF and some supervisors were not aggressive in correcting these deficiencies on the spot. A recommendation to develop more effective means to assure workers implement Radiation Worker work controls and procedures was made by the team.

There was also a lack of consistency in the posting, labeling and special provisions used to control work areas. The team noted instances where survey maps depicting the radiological conditions within work areas could not be easily verified for their accuracy and currency. These deficiencies could lead to worker confusion and to personal exposures beyond those expected and not as low as reasonably achievable (ALARA). A suggestion to consider establishing better controls for the posting, labeling and special provisions associated with work areas was made by the team.

As part of their initiative to improve all aspects of worker safety, the RP department has initiated a programme to encourage, at the individual and contracting organization level, compliance with and adherence to industrial and radiological safety practices. The "Safety Challenge" is a weekly programme wherein each contractor's safety practices are assessed, at one of their job sites, by a senior Tricastin manager. Attention is given to the preparation of the risk assessment, which includes radiological considerations. Additionally, an on-the-job assessment of the implementation of radiological protection measures is conducted. Individual and corporate incentives are provided to each "winning" work site. This is a unique programme for improving the overall safety practices at individual work sites.

6.3 RADIATION DOSE CONTROL

Improvement of the radiation dose control programme at Tricastin NPP has been a focal point for several years. However, on 11 March 1999, a member of the RP staff experienced an overexposure while conducting work in the Unit 1 reactor cavity. The continuing emphasis by management on improving performance has been reflected in several performance measures and has resulted in a programme that meets overall international expectations.

In 1992, approximately 27 members of the Tricastin workforce accumulated > 20 mSv per year. A dose mitigation programme was instituted and has produced consistently improving results so that by 2001, there were no occurrences. This success has been the result of a cooperative effort between the work planning function, the dose monitoring of staff members,

and the institution of an individual dose reduction strategy. This strategy institutes alarms and controls at the 16 mSv and 18 mSv levels, respectively. Through a cooperative effort between the site physician, the RP department and the contractor a jointly developed mitigating strategy is established to ensure that the worker's future work assignments support the overall strategy. The level of success (100%) that has been experienced in reducing the number of individuals with exposures above 20 mSv has not been seen in the overall exposure rate at the site; however, a 20% reduction in the overall exposure has been realized. The site remains, however, above the EDF average (per reactor) due to the high dose work projects (for example, 10-year outage and steam generator replacement that have occurred recently).

The site is also attentive to assuring appropriate controls and protection capabilities are present to guard against internal exposures. Whenever a potential internal exposure activity is planned, a review of the protection measures for ingestion is mandatory. Additionally, any uptakes result in the immediate involvement of the medical staff

Work planning incorporates ALARA considerations into the initial, on-the-job and post-job activities. During the planning process, the ordering department is required to make the contractor aware of any potential radiological challenges. This is reinforced during the pre-job orientation. Feedback is solicited continually during the conduct of the job through audits by both the ordering organization and the RP department. Each milestone of the work activity is tracked to ensure that timely reaction to any unexpected dose accumulations can be made. Finally, the post-job review provides an opportunity to incorporate insights into the planning file for the next time the task is scheduled.

6.4 RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING AND FACILITIES

The instrumentation used at the Tricastin NPP is effective and is being appropriately used for the designed applications. Individual dose monitoring equipment is effective and is available for all potential applications. Specific needs (e.g. neutron dosimetry) are noted as part of the risk assessment for the particular work activity. Gaseous and liquid effluent monitoring equipment are properly installed and functional. The responsibility for the use of the instrumentation is shared primarily between the RP and Chemistry departments. Functional verifications are the responsibility of the Operations department and maintenance is the responsibility of the instrumentation and control division of Maintenance.

The practices for protective clothing at the site reflect the EDF philosophy of treating the RCA as a potentially contaminated area, thus requiring all individuals who dress out in anti-contamination clothes, to include cotton gloves and hard hats. This practice is well understood by all staff members.

The instrumentation used for portable and fixed dose rate and contamination measurement is an area where the Tricastin NPP staff has taken a leadership role for EDF. Conventional instrumentation for contamination reads out in count per second (cps) and typically requires that the technician conduct a conversion process to Becquerels/Curies. Additionally, an accurate reading requires the operator to assure that the instrument is on the proper scale. The Tricastin NPP staff has developed a meter which is sensitive to beta and gamma activity, is self-scaling, and reads out in Becquerels, thus making surveying a simple and, basically, error-proof activity. This instrument has improved technician efficiency and is being integrated into the inventory of several EDF plants. Finally, the staff has shown a unique competence by developing, with a local vendor, a water equivalent matrix type resin source.

This source, which is easier to use and inherently longer lived, has been recognized by the team as a good practice.

6.5 RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

The programme for managing the production and discharge of gaseous, liquid and solid wastes at the Tricastin NPP is well managed and is capable of accurately assessing the releases that are associated with both normal and abnormal operations. Tricastin NPP has improved significantly in its control of liquid releases and is in the top quartile of EDF performance.

Effluent monitoring instruments are positioned in such a manner to effectively monitor the impacts of gaseous and liquid releases at the site boundary and the surrounding environment (out to 10 Km). Appropriate attention has been given to assessing any deviations from the norm. Fixed and portable monitoring capabilities are in place and appropriate quality verifications are present.

Gaseous monitoring is accomplished through direct reading radiation monitors. Releases are managed to minimize their impacts through engineering considerations (hold-up tanks and filters) and process controls. Liquid releases are likewise closely controlled and monitored. A unique design feature of the Tricastin NPP is the underground retaining wall that surrounds the site and establishes an inward water flow pattern. Also, an effluents improvement team, consisting of members from throughout the site organization, has been formed to better manage the reduction of liquid effluents.

Solid radioactive waste is processed through a separate facility. The Nuclear Logistics department manages it and daily operations are contracted. Materials are segregated by hand. This job has the potential for significant internal contamination and, therefore, requires the use of forced air breathing suit. Within the facility, waste is segregated by its ultimate destination. During the review, it was noted that the fixed monitoring devices within the radioactive waste building could be improved. The air monitor present was not one that continuously read the activity in the air; instead, the filter for the sample was only counted every 2 weeks. Similarly, gamma monitoring was only available through the use of personnel hand-held (Dolphy) dosimetry. While, to date, there has been no inadvertent exposures at the facility, these shortcomings preclude real-time monitoring and do not provide the level of assurance expected. A suggestion to consider installing continuous air activity measurement and permanent ambient monitoring devices was made by the team.

6.6 RADIATION PROTECTION SUPPORT DURING EMERGENCIES

Overall, the radiation protection support provided during emergencies meet good international practices. The responsibilities for providing radiation protection support during emergencies are shared between the Nuclear Logistics and RP departments and the medical staff. Medical personnel are on call for emergencies with doctors on call for radiological emergencies. Resources are shared with the Cruas nuclear power plant to assure their continual availability.

Radiological measuring equipment includes both fixed devices and two mobile vans. Detectors and meters are checked regularly; back up power is available, as necessary. Detailed directions (including pictures) assure that fixed monitors can be located and monitored in a timely manner.

The controls for monitoring the radiological effects on plant personnel during accident emergencies are effective. Personnel monitoring is conducted by RP and medical personnel at the emergency evacuation point in Saint-Paul-Trois-Châteaux. Monitoring and decontamination of the evacuation vehicles is also done at this location. Many additional site personnel are qualified and are available to assist the dedicated RP staff, especially in preliminary contamination monitoring at the initial mustering points.

Radiological impacts are communicated to the local officials responsible for public safety based upon an assessment from a formalized flowchart. The consequences of the releases are determined by using a dedicated code and measured data from the meteorological mast (80 m) that is shared with COGEMA. Both effective and thyroid doses are calculated. The consideration of collected and non-collected release paths makes predicted impacts as accurate as possible.

STATUS AT OSART FOLLOW-UP VISIT

In responding to the recommendation and two suggestions in the Radiation Protection area, Tricastin NPP has determined root causes for the issues and taken action that resulted in excellent resolution of the two suggestions and satisfactory progress with the recommendation.

To enhance worker radiation protection performance, input from operators and maintenance personnel was sought to develop clear and specific guidelines for field workers. These guidelines were incorporated in clear pamphlets which were provided to the workers. Expectations in the area of RP included in contractor specifications have been enhanced and exposure forecasts are now done for all work in the RCA. A systematic program for field tours has been implemented so that on a periodic basis all areas of the plant are monitored with attention focused on details of the field application of the standards. These actions have resulted in improvement in work practices at the plant. The team encourages Tricastin to continue its improvement program in this area.

Tricastin has clarified expectations for dose forecasts for work in the RCA, the schedule for surveys in various areas and RP signs at the area. Survey maps are also now available from the computer system. Further management attention has been devoted to ensuring that survey information is shared with contractors during pre-job briefings. ALARA performance is one of the criteria used for granting plant wide incentives.

Several alarming radiation monitors have been added in the radioactive waste storage facility. These monitors are strategically located to quickly detect and provide alarm to workers when unexpected increases in radiation levels occur. During a tour of the facility the team observed that these alarms were installed and functioning properly. People working in the facility have been trained on the procedures for responding to alarms. In addition the plant has approval for a significant upgrade of the facility.

The attention devoted to the RP area by management and workers has resulted in reduced collective radiation exposure, alarms, and contamination. The average collective radiation exposure per unit at Tricastin is now among the best of the 900 Megawatt plants in France. The recent outage on unit 2 was recorded breaking. The collective radiation exposure for the outage was the lowest ever achieved on a 900 Megawatt plant in France.

DETAILED RADIATION PROTECTION FINDINGS

6.2 RADIATION WORK CONTROL

6.2 (1) Issue: Radiation Worker work practices are not adhered to consistently. The workers are not consistently attentive to the details of the controls and procedures that have been put in place.

There were several instances where Unit 3 contractor “guardians” did not observe the radiation protection expectations that have been established by EDF (e.g. wearing gloves and hat; reading books).

A staff member accidentally stepped onto a “clean” step-off pad while wearing potentially contaminated overshoes (Unit 3). The “clean” step-off pad was not surveyed to see if it had become contaminated.

Several instances where craft personnel were noted not to be wearing gloves within the RCA, as required (individual seen carrying 3 bolts in his bare hand because the cotton glove was “not convenient”; individual seen exiting the Unit 3 “hot” changing room without cotton gloves).

The compliance of Radiation Workers with the procedures that have been established to assure their individual safety is essential since radiation protection technicians are not continuously available to monitor and coach workers on proper techniques. Workers must, therefore, be the primary agents responsible for their own safety.

Recommendation: Plant management should develop means to assure that all plant workers effectively implement Radiation Worker work controls and procedures.

Plant Response/Action:

The issue highlighted by this recommendation concerns the checking and monitoring of worker practices in the RCA. It is of a similar nature to that highlighted by recommendation 1.5(1) on industrial safety. It has therefore been addressed using a similar approach :

- Clarifying and promoting reference standards ;
- Ensuring their enforcement through effective presence in the field.

CLARIFYING AND PROMOTING REFERENCE STANDARDS

The technical reference document dealing with the use of personal protective equipment has been modified.

With all French plants determined to place radiation protection and operational safety on an equal footing, a directive was established following the example of safety-significant events and RP-significant events, on the basis of ten specific criteria. In order to disseminate these criteria, a leaflet was distributed and presented by department managers. The criteria are also conveyed to contractors.

The 1998 decree was extensively applied in 2002. Dose forecasts are carried out for all maintenance activities. Based on the forecasting, tracking and analysis of deficiencies, this system helps to improve real-time radiation exposure monitoring and dose optimisation prior to maintenance, particularly for activities with significant radiological challenges.

A memorandum describing what to do in the event of defective basic equipment or behaviour provides managers with guidance as to what position they should adopt if a deficiency is observed.

Terms and conditions set out in contracts for service provision in the areas of industrial safety assistance, RP support and checking of persons and equipment leaving the RCA, have been modified so as to raise our standards. These standards have been presented to contractors at kick-off and prerequisite-action meetings.

ENFORCING REFERENCE STANDARDS THROUGH EFFICIENT PRESENCE IN THE FIELD

The “work supervisors” network was strengthened in 2002 and 2003. One of its tasks is to ensure that requirements stipulated in contracts for service provision are met, including the area of radiation protection.

The weekly industrial-safety challenge organised during outage periods is designed to reward the best job-sites inside and outside the RCA. Radiation protection is one of the main areas reviewed during these inspections. A database has been created in order to collect all information regarding industrial safety and radiation protection. Statistical processing of this information makes it possible to identify potential deviations. On the basis of these results, an awareness campaign on the use of personal protective equipment was launched in July 2002.

In 2002, the industrial safety challenge was extended to activities carried out during power operations.

Management control and field inspections have been reinforced, particularly during outage. Departments have undertaken to carry out a certain number of inspections on job-sites selected by the project team. Members of the Industrial Safety and RP Committee (CSRP) conducted field inspections at critical periods of the outages that took place in 2003: Prior to invert, during fuel handling operations, at end of invert.

During these field inspections, contractors will be involved in the safety challenge in order to reinforce our expectations in the field.

As far as SRM contractors are concerned, SRM contractor supervisors have a programme for each contractor. Monitoring actions are tracked and used to complete partial contractor-assessment forms which are sent, immediately after completion of the job, to the labour relations advisory unit (MRI). These forms are systematically signed by the department manager.

A procedure is being drafted to ensure that contractors check the standards stipulated by contractor specifications and that they commit themselves to these checks (traceability).

As of June 2003, twice-daily inspections have been scheduled during working hours as part of the “Coaching Thoroughness in the Field” initiative (ART). On weekends and public holidays, they are conducted by on-call staff. The aim of these inspections is to provide training in the detection of behavioural deficiencies, to correct these deficiencies and to track observations. Fire-protection, use of personal protective equipment (including basic RCA clothing requirements), countering vandalism, and job-site tidiness are focal points. These ART inspections are helping to improve adherence to rules, including the area of radiation protection.

IAEA comments:

In response to this issue, the plant analysed the root causes for the issue and decided to:

- clarify the guidelines so they could be more easily understood by workers
- have management communicate their expectations
- monitor implementation in the field

Working with teams of operators and maintenance personnel, clear and specific guidelines were developed for field workers. These guidelines were incorporated in pamphlets which were provided to the workers. Expectations in the area of RP included in contractor specifications have been enhanced. Protection and exposure forecasts are now done for all work in the RCA. A systematic program for field tours has been implemented so that on a periodic basis all areas of the plant are monitored with attention focused on details of the field application of the standards.

Feedback to plant workers and contractors is provided in the form of coaching, recognition of good performance and, if necessary, sanctions. The plant is encouraged to continue its improvement program in this area.

Conclusion: Satisfactory progress to date

6.2(2) Issue: The posting, labeling, and special provisions provided to keep dose as low as reasonably achievable (ALARA) are not being implemented in a manner consistent with good international practices and are more focused on national regulations.

Survey maps for work sites were not updated and posted when they were completed because the radiological conditions had not changed from the previous survey.

In Unit 4, room K-216, there was an orange area (second most significant level) which did not have a thorough survey of the area posted.

A Chemistry Technician, who took a primary sample (Unit 3) to perform an analysis let the bottle with the .1 liter sample (activity ~8MBq/kg) stand on the work table for the duration of the analysis (30 minutes) without reducing the exposure impacts (ALARA) by placing the bottle behind temporary shielding which was immediately available.

Posting and labeling radiation areas, and establishing special provisions to keep dose ALARA in a manner which allows plant personnel to quickly and unambiguously know and understand the radiological conditions in which they are working is essential for assuring individual worker safety.

Suggestion: Plant management should consider developing and implementing more effective controls and procedures to assure that posting, labelling and special provisions are implemented in a manner, which emphasizes and supports good international practices, in addition to compliance with national regulations.

Plant response:

On the basis of the OSART findings, the plant set up an enquiry into how it could improve its performance with regard to the posting of information, labelling and special provisions to be made during maintenance work. These measures form part of the effort to strengthen the ALARA approach.

The enquiry pinpointed three main areas for improvement :

- Reference standards;
- Communication and information in the area of radiation protection;
- Monitoring and management.

REFERENCE STANDARDS

In 2002, the Technical Conditions and Specifications relating to ‘providing support in the areas of industrial safety and radiation protection’, as well as the memorandum on ‘contractor support in the areas of industrial safety, radiation protection and fire-protection during outage’ were modified. These documents specify our expectations governing radiological survey maps and information needed by work-team leaders. Information is modified in accordance with changes in system status (system filled, drained, open, closed, etc.), at least twice a week. These modifications are dated and signed by an RP technician.

The list of staff members qualified in the area of radiation dose control has been updated. These people, who are trained and appointed, act on behalf of their department in its relations with the SRM department. They are granted access to individual worker exposure levels and collective department dose levels on the job-

sites in question. Access to this information makes it possible to validate the list of workers able to perform the job, while facilitating the acquisition of experience feedback to improve future work activities.

The 1998 decree has been enforced on the plant. A dose forecast is carried out prior to all maintenance activities. Based on the forecasting, tracking and analysis of deficiencies, this system has helped to improve monitoring and reduce radiation exposure levels, particularly on job-sites with significant radiological challenges.

COMMUNICATION AND INFORMATION IN THE AREA OF RADIATION PROTECTION

In an effort to facilitate access to information on plant radiation dose levels and to facilitate the monitoring and management of radiation exposure on the plant, data is updated and tracked via the plant's key performance indicators. These give the minimum, maximum and average values, which can then be used to calculate monthly department exposure levels.

Standards are conveyed to contractors by the EDF instructing party. Contractor supervisors are also informed so that each of them can check that standards are complied with during job-site inspections.

Radiation exposure targets form an integral part of the performance indicators used by the power operations and outage structures. They are regularly mentioned during project meetings and displayed on indicator graphs.

In addition, since 2003, the relevant plant staff have had access to the RP surveys done during outages on the plant outage computer forum. This system improves the work planning stage as far as radiation exposure forecasts are concerned. In 2004, the computer application "Cartorad" will make it possible to enter surveys on line with a hand-held computer (similar to what is used for Operations rounds). A trend analysis of actual dose rates will also be possible with this system.

SUPERVISION AND MANAGEMENT

A structure has been set up within the SRM department to handle supervision activities. In conjunction with this structure, a contractor supervision programme has been produced for the power operations and outage processes.

The areas covered are "assistance and advice" (during outage), checks at RCA exits, triggering of portal monitors at RCA exits, and radiological survey maps.

Information posters, labels and special provisions set in place on job-sites are also monitored by means of periodic checks carried out by SRM technicians and tracked in a walk-down log.

The number of department-management field inspections has been increased. These inspections are designed to focus on observed deficiencies and correct them by clarifying reference standards.

The chemistry department has changed its lab work practices, resulting in a significant drop in the department's radiation exposure levels. Further action will be taken to bring about necessary improvements in daily operations, by setting up shielding devices, flushing out fume hoods and systematically checking each hood's dose rate equivalent.

Several departments have included a collective dose target in their business plan for 2003.

Achievement of dose targets forms an integral part of the criteria upon which result-based incentives are awarded.

THE PLANT IS MAKING SUSTAINABLE PROGRESS WITH REGARD TO COLLECTIVE RADIATION EXPOSURE

Exposure levels fell from 1.33 man.Sv/year/unit in 2000, to 1.16 man.Sv/year/unit in 2001 and to 0.925 man.Sv/year/unit in 2002, i.e. a fall in collective dose of more than 20% between 2001 and 2002.

At the end August 2003, the collective dose level stood at 0.847 man.Sv/year/unit, leading us to expect an overall annual result (year 2003) close to or less than that of 2002, in spite of difficulties encountered during the unit 1 outage.

IAEA comments:

For this suggestion the plant conducted a root cause evaluation and determined that :

- Expectations and requirements are not clear enough
- Expectations needed reinforcement through management involvement
- Monitoring and supervision should be formalized

Tricastin has clarified expectations for dose forecasts for work in the RCA, the schedule for surveys in various areas and signs at the area indicating the date of the last survey and the survey results. Survey maps are also now available from the computer system. Further management attention has been devoted to ensuring that survey information is shared with contractors during pre-job briefings. ALARA performance is one of the criteria used for granting plant wide incentives. Management tours and worksite contractor supervisors specifically focus on verification of adherence RP rules. Since the OSART mission, the radiation protection department has implemented a monitoring programme specifically for RP contractors.

Conclusion: Issue resolved

6.4. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING, AND FACILITIES

6.4(a) Good Practice: The Radiation Protection Department has assumed a leadership role in developing for EDF products and processes to improve the company's overall radiation protections practices.

The chemistry laboratory, working with a local commercial supplier, has developed and is using radioactive sources containing a water equivalent matrix type resin. This solid phase source is considered as a sealed source. As such, its lifetime (depending on the radio element contains) is 10 years rather than the 2-year life normally specified for unsealed sources. These sources are supplied in standardized shapes, identical to those currently used for measurements, and are available in 3 different sizes (3.0 l, 0.5 l and 50 ml).

Compared to liquid sources, the advantages of this product are as follows:

- No handling of liquid radioactive sources
- No radio element migration phenomenon within the source container
- Source retrieval by vendor (no destruction requirement)
- Longer period of use (depending on the radio element half life)
- No spread of contamination in the event of being dropped

6.5. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

6.5(1) Issue: Environmental monitoring in the Solid Radioactive Waste building could be improved.

The Solid Radioactive Waste facility is a facility used to sort and consolidate solid radioactive wastes that have the potential for generating airborne contamination as well as increases in ambient radiation levels.

The filter for the air monitor is not automatically counted; therefore, there is no continuous alarm capability. The filter is counted every 2 weeks by a Radiation Protection technician and the results are posted in the work area.

Only 2 portable dose meters (e.g. Dolphy) are available in the Solid Radioactive Waste facility. Because of this, there is no continuous or consistent monitoring of the ambient radiation levels.

The quantities of radioactive waste stored in the facility establish a potential for unexpected exposure which, if not monitored, could impact personal safety.

Suggestion: Plant management should consider installing in the Solid Radwaste Building a Continuous Air Monitoring device and permanently mounted radiation detectors with “real time” monitoring and alarm capabilities.

Plant Response/Action: In order to have permanent and “real-time” facilities for monitoring ambient air contamination as well as continuous radiation detectors with alarms inside the solid radioactive-waste building, the plant conducted a technical and economic study during the first half of 2002.

As a result of this study, which was conducted by the Industrial Safety/RP Department (SRM) and the technical advisory unit, it was decided to purchase various air contamination and radiation monitors. This equipment has been installed in the waste treatment building (BAC) and integrated in the SRM monitoring and calibration programme.

Instructions for use and response to alarms have been drawn up and will be available as soon as this equipment is installed. Instructions for use and response to alarms have been drawn up and communicated to the staff working in the waste treatment building

As the solid radioactive-waste building does not have its own store for the distribution of radiation meters, a number of additional meters have been made available to the person in charge of the area in order to carry out specific checks.

The new organisation implemented in 2003 is scheduled to be improved in 2005 by the implementation of corporate conclusions on the waste treatment building issue. The following modifications will be implemented:

- construction of single flow changing rooms for male and female workers,
- construction of a contained sorting area made of concrete,
- modification of the ventilation system, implementation of airborne contamination monitors at the building stack.

IAEA comments:

Tricastin has added several alarming radiation monitors in the radioactive waste storage facility. These monitors are strategically located to quickly detect and provide alarm to workers when unexpected increases in radiation levels occur. During a tour of the facility the team observed that these alarms were installed and functioning properly. People working in the facility have been trained on the procedures for responding to alarms.

In addition the plant has approval for a significant upgrade of the facility. The upgrade will improve the area where waste is sorted and it will include a full complement of real time radiation monitors and alarms.

Conclusion: Issue resolved

7. CHEMISTRY

7.1. ORGANIZATION AND FUNCTIONS

At Tricastin NPP, the activities related to the field of chemistry and radiochemistry are under the responsibility of the Chemistry and Environment Department (MCE). The MCE department and operations department make up the ‘production’ group. The laboratory branch of MCE is divided into two parts: plant chemistry and environmental chemistry. In addition, the method team, which is composed of experienced chemists, is responsible for planning activities and for drawing up procedures and instructions. There are also chemistry experts in the engineering department responsible for long-term tasks within the fields of plant and environmental chemistry. Responsibilities of this group are described in the Engineering department organisation memorandum.

Plant chemistry is responsible for the chemical treatment at the installation, primary to secondary leakage monitoring and for fuel integrity monitoring. It is also responsible for implementation of necessary corrective actions, when deviations are identified.

Environmental chemistry is responsible for the production of demineralised and drinking water, as well as liquid and gaseous releases measurement. It is also responsible for performing qualitative and quantitative sipping tests, when a leaking assembly is identified.

There are no shifts in the chemistry area, but there are eight on-call chemists at all times, ready to help the operation staff when a chemistry anomaly appears.

The interface responsibilities and the corresponding flow of information to operations are clearly described. MCE staff has regular daily communication with the control room operators. The control room staff has access to the chemistry results.

Chemistry has established a very comprehensive system of chemistry performance indicators. The assessment of performance is regularly carried out. The team proposed a good practice in the area of chemistry performance indicators. A pilot project of self-assessment was also performed in the chemistry department using the EFQM principles. The main weaknesses of the performance were identified by evaluation of nine criteria. A comprehensive action plan was established by the department head with the aim of improving the performance of the department.

Contractors are used for maintenance of on-line analysers and must be approved at corporate level.

Training and qualification responsibilities are clearly defined in the training memorandum. Certain levels of authorisation are prescribed for each hierarchical level. Each employee has his own individual training record. Training is sufficiently monitored by managers. Shadow training for the new workers is performed. The job rotation within the workstations is conducted within both parts of the laboratory branch.

There have been significant improvements in the recent past connected to the effective restructuring of chemistry.

Corporate level organisations play an important role in the field of chemistry and radiochemistry. The most important ones are the Chemical and Metallurgical Laboratories (GDL), the Environment Group (GENV) and the Fuel Branch of the Engineering Support Unit (UNIFE), which are involved in establishing the specifications and policies in the

chemistry area. They also collect the results and communicate the experience feedback among the plants.

7.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

Chemistry control of the plant and monitoring programme for the primary and secondary systems were established by GDL based on materials used in the plant.

The chemistry specifications are well defined and structured and the expected values and limit values for every parameter are determined. If the expected value is exceeded, a possible anomaly should be identified and eliminated in order to get back to normal operating conditions as soon as possible. A corrective measure must be carried out immediately when a limit value is exceeded. Chemists determine the best action to be carried out to get back to normal values.

Primary chemistry is well maintained using the co-ordinated lithium/boron treatment. Appropriate consideration is given to start-up and shutdown chemical treatment when the special chemical specifications were implemented with the objective of dose rate build-up minimisation. Dose rate build-up is regularly checked during outages. The in-situ gamma measurement is provided regularly by the corporate level organisation. The modified lithium/boron chemistry treatment has recently been used in Unit 4 so as to decrease the value of high temperature pH. Up to now, the steam generators in units 1, 2 and 3 have been replaced.

The automatic injection system of lithium to the primary circuit was established in Unit 2. The team recognized as a good practice the automatic injection of lithium.

Secondary chemistry is well maintained according to the specifications which were modified after condensers were replaced with implementation between 1992 and 1995. In the recent past, problems with the quality of condensate appeared in units 3 and 4 caused by the intake of cooling water into the condensate. The erosion of some tubes in the upper parts of stainless steel tube bundles was identified by visual inspection. This problem will be addressed using protective plates.

The all-volatile treatment (AVT) is used which is established by injection of hydrazine upstream of the condensers. The feed water pH value is maintained at 9.5. Morpholine is injected downstream of the condenser extraction pump.

Modified secondary chemistry for unit 4 was established at the corporate level (GDL) using the injection of boric acid, to reduce the corrosion of steam generators. There are leakages from the primary to the secondary side of steam generators in this unit which have not reached limiting values and the steam generators will be replaced during the ten-year outage in 2004.

A mobile demineralisation station is used for the cleaning of the secondary circuit after an outage. A special demineralisation station for the generator stator cooling water system was also installed to improve the chemistry of the system.

The quality of demineralised water produced at the demineralised water production plant is properly monitored by on-line measurements of pH, conductivity, sodium and silica. The demineralised water production plant is automatically shutdown, when the conductivity of produced water exceeds a certain level.

Flow Accelerated Corrosion (FAC) is followed up by the mechanical department via the CICERO software for prediction of FAC damage in certain pipelines. Measurements of wall thickness and the chromium content are carried out for critical components.

Diesel generator fuel, lubricant oils and the diesel generator cooling water are regularly sampled and analysed.

An effective radwaste minimisation programme was established on the liquid effluent releases. A multi-professional team was established, composed of representatives of different departments. The significant decrease of liquid effluent was achieved in the recent past.

7.3. CHEMICAL SURVEILLANCE PROGRAMME

An extensive chemical surveillance programme exists in accordance with the chemical specifications from the corporate level organisation.

The plant is equipped with on-line analysers for monitoring the main primary and secondary parameters. The records from on-line analysers are also registered in the control room and alarms for control room operators are provided when the limit values are exceeded.

All on-line analysers are properly and regularly calibrated.

The schedules and sampling plans of analyses are clearly identified by the corporate level MERLIN software system.

Good analytical procedures are easily accessible at every chemistry workstation. Laboratory analytical equipment is also regularly calibrated using the appropriate standards.

Analytical performance of laboratory personnel is checked using unknown samples or double-checks in case of problems with the analysis.

Laboratories regularly participate in corporate crosschecking analyses of chemistry and radiochemistry parameters. Twenty-seven laboratories within EDF plants participate in this crosschecking process. Significant improvements of laboratories occurred in the recent past. On-line analysers are also crosschecked regularly at corporate level.

Fuel integrity is monitored by gamma spectroscopy measurement of grab samples of primary circuit coolant. The steam generator primary to secondary leakage is measured by ^{16}N activity monitoring in steam. Alpha measurements are also performed for determining transuranium radionuclides activity within the plant systems and effluent releases.

Chemistry results are well documented and communicated by the MERLIN system.

7.4. CHEMISTRY OPERATIONAL HISTORY

The results of all the analyses along with some on-line analysers data have been computerized since 1984. Two years ago, the new MERLIN corporate level computerized system was applied. Three levels of trend analysis are performed. Team leaders generate weekly reports of the main important data.

The planning engineers are responsible for creating monthly reports with the trends of all important parameters for primary, secondary and environmental chemistry, as well as a description of the state of all three barriers. Monthly reports are communicated to the relevant departments and to plant management.

The engineering group chemists are responsible for creating the annual reports for secondary, primary and environmental chemistry. Chemistry is also included in the power plant annual nuclear safety report created by the nuclear safety department and communicated to the regulatory authority.

An appropriate system of experience feedback was established within the MCE department.

7.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

Most laboratories are appropriate for different analysis tasks. They are clean and well maintained. However, the secondary laboratories especially for Units 3 and 4, are more obsolete, all could be renovated. They will be renovated when on-line oxygen meters are replaced this year. Furthermore, some weights are not always used in accordance with good international practices. The team provided a recommendation on this issue.

Some laboratory instruments are very modern and all instrumentation has exceptional redundancy. Instruments are in good condition and are operated by skilled staff. The documentation including calibration data is kept close to each instrument. The laboratories and most of the chemistry areas are adequately equipped with emergency showers and eye washers. However, it was observed that the industrial and personal safety practices are not always in compliance with good international practices. The team provided a recommendation in this area also.

Samples to be measured in the hot laboratory are inserted in closed plastic bags for transportation.

Chemicals with one exception were appropriately labelled with the expiration date and recorded in the simple quality control information system.

All on-line analysers are labelled with the dates of the last and the next calibration. Different colours of labels are used for different areas. The regular periodic and preventive maintenance of on-line analysers is provided. A five year-annual plan is also established for the future replacement of analysers.

The plant has installed a sufficient post accident sampling system (PASS). The measurement of gas phase is performed by KRT chains (total beta activity and dose rate) and additional analysis will be performed at corporate level. The liquid phase could be sampled depending on the type of accident from the shielded cabinet at the hot laboratory (REN) or from the special shielded cabinet connected downstream of the low-pressure injection system pump. There is no special analytical equipment to perform PASS liquid samples. The total gamma activity and the gamma spectrometry measurement can be performed with the appropriately diluted sample.

7.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

There is a comprehensive system of quality control of operating chemicals and resins established at corporate level (GDL). The criteria of purity and limit values of impurities for all operating chemicals are prescribed in the special procedures. A similar procedure also exists for all resins. GDL is also responsible for performance of all necessary analyses.

Every producer of operating chemicals or resins have to be certified by GDL. There is a list of allowed producers, products and packaging, certified by GDL and updated each time there is a change. All producers are audited every three years. Such a system also exists at corporate level, when a new operational chemical is needed.

Methods engineers are responsible for dealing with PMUC (Product and Material for Use in Power Plants) chemicals within the power plant. There is a specified process for checking chemical products delivered to the plant, and the MCE department also has a special warehouse for PMUC operating chemicals. A similar system is used for laboratory chemicals. All responsibilities and rules for necessary labelling, supply and checking of delivered chemicals are clearly described. However, the team observed that the control and storage of some laboratory chemicals, mainly substances used by maintenance or contractors, is not fully appropriate to prevent potential improper use. The team provided a recommendation concerning chemical labelling.

STATUS AT OSART FOLLOW-UP VISIT

Appropriate action has been taken on the OSART issues. The one recommendation and two suggestions made by the original OSART team have now all been resolved.

Nowadays, the Chemistry and Environment Department (MCE) is preparing a project to take into account the new analytical techniques and treatment processes linked to the updated effluent release permit.

Efforts have been made to improve the industrial safety practices and facilities within the laboratories, including the purchase of equipment to reduce the risk of oxygen deficient atmosphere.

In addition, the department has developed and implemented a programme to involve its staff in improving ALARA practices at work stations, in particular at the primary sampling glove boxes.

Control of operational chemicals and other substances has been significantly improved at the plant, extended beyond the PMUC programme to include all products used and brought onto the plant by departments and contractors, the setting up of a database including technical data sheets and safety & risk information and effective stock control. Once all items have been included into the database, the plant will analyze the possibility of reducing and replacing hazardous substances by other less risky products. This programme goes beyond the use of chemical products to include parts and stock in the warehouse and oil stores and the team observed good standards and practices in this area.

DETAILED CHEMISTRY FINDINGS

7.1 ORGANISATION AND FUNCTIONS

7.1(a) Good practice: A very comprehensive system of chemistry performance indicators is established. The main chemistry performance indicators connected to chemistry, radiation protection effluents and the environment are used with short-term trend evaluation (3 weeks). Expected and limit values of indicators are also expressed. The values are upgraded once a week and are easily accessible for all the plant's employees via the electronic IT system. In the form of a weekly newsletter with pictograms, the system is used for the presentation of chemistry results for plant management and other departments.

This type of relationship has the advantage of enhancing the commitment of plant management and other departments in the chemistry area. As a result, chemistry deviation treatment is performed more rapidly.

7.2 CHEMISTRY CONTROL IN PLANT SYSTEMS

7.2(a) Good practice: The automatic injection system of lithium to the primary circuit was established in Unit 2 as a prototype. The system uses a special software for continuous calculation of lithium needed for the circuit. The on-line measurement of conductivity with the feedback loop makes it possible to comply with lithium/boron specifications during operation and during hot standby. An alarm is provided to the control room operators when a problem occurs with the injection system.

This system is especially useful for power plants operating in load following mode with very frequent variation of power (up to the hot standby), which are always accompanied by boration and dilution operations. This phenomenon is compensated by an automatic lithium injection system, which is used to compensate in real time whenever the limit of the lithium-boron diagram is exceeded, and to prevent excursion at low pH. 25 load reduction transients were carried out, which qualified the prototype and the lithium concentration was constantly maintained with a deviation below 0.05 mg/kg relative to the reference value.

7.5 LABORATORIES, EQUIPMENT AND INSTRUMENTS

7.5(1) Issue: Laboratory practices and performances do not always correspond with the good international practices to ensure industrial and personal safety, and minimise doses.

- the fume-hoods at the central laboratory of Unit 3,4 are not regularly tested from the point of view of sufficient air flow.
- the chairs at the central laboratory of Unit 3,4 (controlled area) are not covered by material which allows easy decontamination of chairs (plastic). There are covered by textile.
- during the observation at the control area laboratory of Unit 3,4, the technician performing the sampling and analysis, left the bottle with the sample (about 1 liter of primary coolant with activity about 8 MBq/kg) on the table without shielding while he was preparing the analysis (about 30 minutes). There was one of the shielding close by (about 0.5 m), with some other bottles behind it.
- the deficiency in industrial safety was observed during the visit at the chemistry stock of the laboratory of Unit 1,2. There are no protective tools (shield and apron) there, although the concentrated sulphuric acid (96%) in glass bottles is stored there. There is no eye washer or emergency shower there and the nearest source of water is about 30 m away with complicated access.

Without changing these laboratory practices the industrial, personal and radiation safety of workers can not be assured.

Recommendation: The good international laboratory practices and performances should be applied to assure the industrial, personal and radiation safety minimizing doses.

Plant Response/Action:

The root causes of this recommendation are the following :

- Poor co-ordination of industrial-safety initiative within the chemistry labs;
- Poor follow up of the questions concerning radiation protection;
- Non-compliant or inadequately maintained equipment or rooms.

The laboratory branch has addressed this recommendation by taking its investigation beyond the OSART findings, in order to identify chemistry-related hazards and to propose preventive measures.

HAZARDS ASSOCIATED WITH THE MANAGEMENT OF CHEMICALS

A working group consisting of field operators and co-ordinated by the department manager was formed in 2002. The following improvements have been made :

- Designation of 3 stock managers and 1 planner
- Installation of a shower and eye-fountain in each of the 3 chemical storage areas.
- Installation of acid-resistant protective equipment in chemical storage areas.
- Elimination of sulphuric acid stocks kept in breakable glass bottles.

- Systematic purchase of acids and bases in unbreakable containers (plastic safety bottles instead of glass bottles).
- Systematic purchase of acids and bases in small containers (0.5 – 1 litre).
- Purchase of manual pumps to facilitate decanting of sodium hydroxide.
- Elimination of unnecessary stocks (standardised items in all three labs, identification of substances no longer being used).
- Computerized stock-tracking system.
- Purchase of 3 trolleys with retention capacities

ANOXIA HAZARDS

Anoxia hazards are due to the use of liquid nitrogen in radiochemical counting rooms, the use of CO₂ to make ice blocks, and the presence of a nitrogen inflow pipe in the nuclear sampling rooms. In order to provide better protection against these hazards, 19 portable oxygen meters were purchased in 2002 so that anyone working in these rooms would be equipped. In addition, 8 stationary oxygen monitors were installed in 2003. These monitors are specifically allocated to one room and are fitted with a warning beacon and siren. They are used as a back-up to portable oxygen meters and alert workers before they enter the room. In 2002, total investment costs amounted to 34 kEur.

RADIATION HAZARDS

At the beginning of 2002, the MCE department set up monthly indicators to track collective radiation exposure. Dose forecasts have also been carried out since December 2002.

Glove boxes siphon in the REN laboratory for units 3/4 were replaced in 2002, in order to reduce dose rate.

Lab worker radiation exposure levels fell from 31.26 man.mSv in 2001 to 29.23 man.mSv in 2002 (6.5% decrease).

An ALARA working group consisting of field operators was set up in 2003 in order to identify better practices. This group is working on a number of aspects: installation of shielding, identification of the work station with the highest dose (REN), flushing of REN glove box, systematic checking of dose rate outside each glove boxes, improvement of work practices from an ALARA perspective, raising field-operator awareness, improvement of sampling methods. The main result is a systematic trend analysis of dose rate of REN glove boxes.

HAZARDS ASSOCIATED WITH CONTAINMENT OF RADIOACTIVITY

In the hot labs, chairs which did not lend themselves to decontamination were replaced by chairs allowing easy decontamination in 2002.

20 Glove-boxes in the nuclear auxiliary building are being renovated in 2003 so as to improve their integrity. An annual visual glove-boxes surveillance test has been instituted (e.g. glove integrity, pressure reduction, seal condition, cleanliness, etc.). Glove-boxes renovation costs amounted to 60 kEur.

A contractor company was given the job of checking fume extractors in 2003 (16 kEur). Non-compliant fume extractors will be renovated in 2004 (50 kEur). In the future, we will be switching over to an annual fume-extractor checking contract.

IAEA comments:

All actions associated with the recommendations have been addressed adequately, including :

- Handling of chemicals
- radiation protection and contamination work practices,
- industrial safety practices and equipment
- the setting up of indicators and trends for radiation exposure risks at work stations.

Further actions are planned for next year, including controls and replacement of fume hoods.

During the visit, the team encouraged the plant to analyse signposting and equipment associated with emergency exits from labs and chemical stores.

Conclusion: Issue resolved

7.5(2) Issue: Laboratory practices and performance do not always correspond with the good international practices to ensure the quality of analysis.

- The balance used for weighing of calibration standards (precision weighing) at the central laboratory of Unit 3,4 (controlled area) is placed on a special table, but directly in the corridor along the laboratory rooms. There is no special and separated space for weighing.
- Two other balances used for weighing of calibration solutions and reagents were observed at the environmental laboratory, and are not placed in a special and separated space with limited access. One of these balances was placed directly on the working table at the lab.
- During the visit at the REN laboratory Unit 3,4 (controlled area), the balance was observed, for weighing of calibration solutions and reagents (precision weighing) placed on a special table, but not placed in a special and separated space.

Without changing some laboratory practices the quality of analysis cannot be preserved.

Suggestion: Consideration should be given to improve laboratory practices and performance with good international practices. The team did recognize the good results from the cross checking analysis.

Plant Response/Action:

The main root cause was insufficient balance checks which does not guarantee a good functioning. The approach for which we opted was to verify and confirm the accuracy of our weight readings rather than setting up special weighing rooms. We also decided to address the pipette-measurement issue using the same approach we took with the scales.

We therefore purchased 3 sets of standard weights in 2002 in order to institute a monthly scale check, which we did at the beginning of 2003. Scales are now monitored monthly using a checking sheet, like all other measuring apparatus. This surveillance test has also enabled us to identify scales requiring repair or withdrawal.

Scales also undergo annual maintenance by a contractor company.

The scale in the central lab for units 3/4 is now equipped with a Plexiglas cover to protect it from ventilated air flow.

A computerized pipette-calibration bench was also purchased as a result of benchmarking from a visit to Dukovany NPP. Pipettes can now be checked for validity on a three-monthly basis. The bench is also fitted with a Plexiglas cover.

Total investment costs amounted to 12 kEur.

Another action was to define a new specific local training course about quality of analysis and uncertainties. The aim is to provide training to technicians in accordance with the apparatus used in Tricastin. These courses have been performed since 2002. 30 technicians are now trained. In 2004, courses about spectro-alpha analysis and boron measurement are planned.

IAEA comments:

The approach implemented by the plant has differences from what was proposed during the OSART mission, but is however in line with international practices. Control records have been used in all measuring equipment, including balances. Even if the suggestion did not require pipette calibration, new periodic tests for pipette-calibration have started this month and results from now on will be analyzed versus the accuracy required for use of these materials in labs. Weighing standards could be checked and certified by external lab periodically.

Conclusion: Issue resolved

7.6 QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

7.6(1) Issue: Control and storage of some plant chemicals and mainly substances used by the maintenance department or contractors is not fully appropriate to prevent potential incorrect use.

- during the laboratory visit (Unit 1,2 chemistry laboratory), the volumetric flasks containing some liquid were found in the capillary electrophoresis room. There was no expiration date of the solution on the label of one volumetric flask with standard solution (the mixture of chlorides, fluorides and sulphates). There was no label on the second volumetric flask, but only a hand-written indication of phosphate with additive.
- fireproof cabinets in the electrical warehouse contain chemicals and lubricants, which are not identified with the Product and Material for Use in Power Plants (PMUC) symbol. Plant policy clearly defines that only products marked with this symbol should be allowed for use in safety related metallic equipment in nuclear plants.
- during the inspection of the turbine hall of Unit 3, one person was observed using the conservation lubricant for turbine without any labelling specifying the approval for using it for this purpose.
- oily waste stored in a barrel, which was not labeled, adjacent to a GFR pump on Unit 3 was observed.

Improper storage and use of plant chemicals and other substances may sometimes lead to increase the risk of inaccuracy of analysis, potential corrosion or other negative impact on plant systems and equipment.

Suggestion: The plant should consider keeping up the efforts of the PMUC approach, which is already well established at the plant, so that products used by maintenance and contractors are at the same quality level as chemistry.

Plant Response/Action:

The root causes of this recommendation are the following :

- Process insufficiently co-ordinated and checked
- Lack of concern and involvement of the workers
- Insufficient knowledge of the risks
- Poor control of the entering flow

The system used to manage PMUC items (products and material for use on power plants) forms part of a wider approach to the management of chemical substances. This approach was implemented in 2003 as part of the ISO 14001 certification process. It is designed to protect against industrial safety hazards, environmental hazards, corrosion hazards and circuit pollution. It is structured in the following manner:

AUTHORISATION OF CHEMICAL SUBSTANCES

In 2002 and 2003, Tricastin started using the OLIMP database as input on substances was gradually provided by headquarters. This database is used to consult industrial safety datasheets on line and track authorisations granted by the occupational health and medical service. All plant maintenance workers have had access to this database since 2003.

INFLUX MANAGEMENT

The main point of influx is the warehouse. MCE chemicals have been supplied by the warehouse since 2002, as is the case for chemicals used by other departments. Management of these chemicals is now standardised and fully computerized. The PDP section keeps an inventory of chemicals brought onto the plant by contractors and authorises their entry.

STORAGE OF CHEMICAL SUBSTANCES

Plant departments have brought their chemical storage conditions into line with regulatory standards (purchase of safety cabinets, retaining devices, separation of incompatible substances, etc.). In addition, the nuclear fuels and general services department (GNU) has also set up collection points for waste such as solvents, lubricants and greasy rags in the turbine building during outage periods. The plant also implemented a stock reduction programme.

MANAGEMENT OF EXPIRY PERIODS

In addition to supplier labels, the warehouse stamps the expiry date on its labels if the product is subject to expiry.

LABELLING

As some suppliers do not affix PMUC labels, the warehouse started adding the PMUC symbol to its labels in January 2003. This is a simple way for workers to know if a chemical is a PMUC product and makes it easier to detect deviations.

In addition, the MCE department has paid special attention to the labelling of solutions.

HANDLING OF CHEMICAL PRODUCTS :

Decanting receptacles are now dedicated to one product only. All the products which can come into contact with primary and secondary circuits are PMUC or manufacturer recommended. The products which are used on QS or IPS materials are indicated in the procedures.

RAISING STAFF AWARENESS WITH REGARD TO THE HANDLING OF CHEMICALS

During training sessions organised as part of the ISO 14001 certification process, the management of chemical substances is discussed. This helps to raise worker awareness regarding the associated risks. Furthermore, risk assessments now factor in chemical risk. This awareness initiative is also aimed at contractors having to use chemicals. New specific training sessions are now implemented for those workers frequently using chemical products (MCE, SLS and GNU dept).

FIELD INSPECTIONS

In order to ensure that chemicals are properly managed, field inspections systematically include this aspect. Examples include Friday-morning on-call staff inspections, daily ‘thoroughness-at-work’ inspections, industrial safety challenges, checks carried out on fenced-in storage areas, environment audits and half-days devoted to housekeeping.

CHEMICALS LEAVING THE SITE

Environmental analyses carried out as part of the ISO 14001 process help to ensure that disposal routes comply with current legislation. The nuclear fuels and general services department (GNU) has been centralising the management of conventional and non-conventional waste for the plant since installation of the transitory waste facility in 2002.

Coordination of the whole process :

The MCE dept manager co-ordinates the chemical products process. In order to implement each month accurate actions in the chemical products process, indicators are analysed monthly as part of environmental performance review :

- Total number of chemical products on plant;
- Purchase volumes of chemical products;
- Stocks of chemicals products;
- Number of accidents and minor injuries with chemical products;

- Number of chemical products authorized in OLIMP database;
- Number of accidental releases in to the environment;
- Number of chemical products from subcontractors, not yet in OLIMP database.

From the results of these indicators, actions are decided for implementation.

IAEA comments:

Chemistry is the department responsible for coordinating the programme to control all chemicals and other substances in the plant. A significant improvement has been found in all phases of the process. A complete inventory of products used by EDF and contractors in the plant has been established. All technical information concerning chemicals and products are inputted into a data base (OLIMP). All PMUC products in the warehouse are identified, an identification sticker being added when the supplier has not marked up the products individually. A thorough programme to control stocks of substances has been established according to their use. Use of specific containers for bulk disposal in the plant are adequately identified.

Further actions are planned for next year, reducing and replacing hazardous substances by others less risky products.

Conclusion: Issue resolved.

8. EMERGENCY PLANNING AND PREPAREDNESS

8.1 EMERGENCY ORGANIZATION AND FUNCTIONS

In France, a national policy exists to implement emergency preparedness on a national, regional and local level. Tricastin NPP, responsible for onsite planning, and the 'Préfet du Département de la Drôme' who is the regional authority in charge of offsite emergency planning and preparedness are well co-ordinated. EDF at the corporate level supports emergency planning. National authorities also support emergency planning and back-up while also maintaining international relationships. This close co-operation, communication and data transfer are well established between all partners and presents a good foundation for emergency preparedness. Together with the support supplied by the corporate level of EDF, gives a good basis for the utility to handle an incident or accident in an effective way and to protect the public in case of an incident or accident.

Responsibilities in all areas are well defined and staffing and resources are assigned to the emergency tasks. It should be pointed out that due to the commitment of the Tricastin NPP management team in charge of emergency planning, that improvements in several areas of the emergency organisation have been implemented. Regarding staffing and organisation of communication between emergency centres on site, additional personnel have been dedicated to special tasks in the onsite emergency centres (Postes de Commandement, PC) of the emergency organisation. People are dedicated to improve the data transfer from the control room to the on site emergency management centre (PCD), and a specialist is detached as a liaison person to the Prefect. An improvement of communication and data transfer has been implemented by introducing information technology into the communication process.

Due to its geographical position, Tricastin NPP is close to the border of 3 neighbouring 'Départements'. In case of an emergency in each 'Département' the Prefect would be in charge of offsite emergency preparedness for his 'Département' with the 'Préfet du Département de la Drôme' in the lead. It is well understood that the 'Préfet du Département de la Drôme', who is alerted by Tricastin NPP, would immediately forward the alert and the information to the neighbouring departments.

Basic emergency functions of emergency preparedness are well covered. Tricastin NPP co-operates with the offsite emergency organisation and has good contacts and co-operation with supporting organisations. Equipment dedicated to emergency preparedness in the different centres is modern and well maintained. Exercises have been performed and have resulted in important feedback and improvement of the plans and procedures. Regarding training and competencies of the personnel of the emergency organisation, Tricastin NPP has taken a leading role to provide the competencies necessary to perform the tasks and the knowledge and training required.

The plant has also taken a leading role in several other areas in improving emergency preparedness and contributes to activities on the corporate level of EDF. This feedback has been instrumental in reforming some areas of emergency preparedness of the EDF fleet. The plant is encouraged to continue its efforts in this field.

8.2 EMERGENCY PLANS

Emergency plans have been developed by all organisations involved. EDF corporate level provides a basic emergency plan which is modified and amended to the extent necessary by the local emergency management organisation of the NPP. On a regional level the staff of the crisis centre of the Prefect prepares a plan for Tricastin NPP, the Prefect contracted a former staff member of Tricastin NPP to provide support in the development of the plan.

Due to a decree of the French Government issued to improve the protection of the public, the NPPs are put in the position to trigger sirens in the event preventive protective measures must be initiated quickly under special conditions. These sirens actually are implemented or under construction at the sites in France and are considered an important contribution to the protection of the public. A new off-site emergency plan is under development which will take account of this situation. Though the Prefect still is responsible for emergency preparedness and will be in charge to make decisions, the new philosophy may put a higher demand on the preparedness and actions of authorities on the local level. The authorities on the local level are in close contact with the Prefect in this area. The team encourages Tricastin NPP and the regional authorities to support the local authorities in the preparation of documents, action sheets and information.

Regarding site emergency preparedness, Tricastin NPP is in a special situation due to the fact that chemical plants processing and handling potentially hazardous chemicals such as UF₆ and HF are neighbouring the site. Due to its unique situation in the EDF-fleet, these hazards are not covered by the corporate plan. Tricastin NPP has made an effort to include this potential hazard into its onsite emergency plan and has worked out procedures to handle such external events. Additionally, the plant has worked out an agreement with the neighbouring company, COGEMA, on notification and on mutual use of the information centres available on each site in case of an accident. The effort taken is recognised by the team, but the team suggests that Tricastin NPP consider seeking agreements to be quickly informed (within less than 15 minutes) of an accidental release in one of the nearby chemical plants.

The emergency plan of Tricastin NPP covers the operation of the emergency centres which are necessary to handle an accident considering several levels of severity and consequences. The actions necessary are well covered by procedures for emergency centres, which allows assessment of the source term and to activate and perform the emergency response in a convenient way. Due to the well scheduled structure of communication and of transfer of messages to the corporate level of EDF, and to the offsite authorities, the information on the status of the plant and recommendations on countermeasures can be provided in due time.

Additionally, to the agreement with COGEMA, further issues have been worked out to support the emergency preparedness in case of need. These agreements cover the supply of busses by a transport organisation, the treatment of contaminated or exposed persons in hospitals, the support by neighbouring nuclear power plants in the dispatch of measuring vehicles or sending experts to the Prefecture of the neighbouring 'Départements'.

Material to be implemented in case of an accident is available according to the design of the plant and well maintained. Additionally special devices, hydrogen combiners, are available from a regional pool and may be brought to the site in case of an accident.

For offsite emergency preparedness, an emergency plan is available and a new plan is under development. Effort is taken on a regional level to co-operate with schools to identify suitable places for intermediate protection of the pupils before they are evacuated and to advise the teachers and pupils on behavioural conduct. Support is available from the civil defence of France and well defined. If the need arises support can also be called in from military forces.

8.3. EMERGENCY PROCEDURES

To guide the actions of the staff of the onsite emergency centres and of the staff performing actions in case of an emergency, good procedures have been implemented. Additional to the set

of procedures derived according to the corporate level basis, Tricastin NPP has taken special actions to improve two fields of emergency preparedness. A procedure to implement protective actions against a threat due to hazardous chemicals approaching the plant and a procedure on the distribution of iodine tablets to ensure the protection of staff against radioactive iodine have been worked out. The procedures available to cover emergency preparedness actions are good, well prepared and are within a QA-system. Action sheets are enclosed in a plastic sleeve. In connection with the QA-process, this ensures completeness of the forms and is a good contribution to effective performance of emergency preparedness. The procedures have been tested in exercises and feedback has been implemented from the experiences gained. In the procedures the action steps to be taken are well defined and allow for graded response. The team, however, recognised that the procedures do not provide a space to sign off actions taken. The team made a suggestion in this area.

The procedures available cover all necessary actions to be taken by the emergency organisation in case of an emergency and were found to be effective.

Notification and classification of the situation are performed by the staff applying dedicated charts. The data is supplied from the plant control room and is transferred and checked by dedicated staff. In the evaluation and judgement of the status of the plant and the potential consequences, a diagnostic and prognostic approach is applied to judge the three barriers available to retain the radio nuclides (3D/3P-approach). In this judgement and especially in the evaluation of measured releases from the stack, care is taken to account for uncollected leaks from the containment to assure a conservative judgement of consequences. Recommendations on protective measures for the staff and the public are based on the prognosis of the situation. Additionally to the actions taken in the development of new procedures, Tricastin NPP is the first unit of the 900 MWe EDF fleet of to implement the state oriented approach in the handling of incidents and accidents of the plant in the control room. Staff of Tricastin NPP has taken a leading role to develop, to test and to implement the procedures in co-operation with the Bugey training centre. This is considered an effective process in the improvement of emergency preparedness.

8.4. EMERGENCY RESPONSE FACILITIES

Tricastin NPP has implemented emergency response facilities to host the staff of the emergency organisation on site. 'Postes de Commandement' (PC) have been installed for management of the crisis (PCD), for assessment of the situation (PCC), for technical support (PCM), for the support of the communication transfer between the centres (PCL) and for the evaluation of the status of the unit in parallel to the operators in the control room (ECL). These centres generally are well equipped and operated. Documents and procedures are updated regularly. An emergency centre is available to host the PCD, PCC and PCM. This centre has a filtered ventilation system and food supplies for a certain time. It is designed to allow the entrance and exiting of the building during an accident and to decontaminate persons who arrive. The centre gives a good environment for the staff active in case of an accident. To improve the protection of this centre, Tricastin NPP is encouraged to evaluate whether a contamination transfer might be possible during persons entering or exiting the centre and in case to take appropriate measures for prevention.

The communication and information transfer between the centres has been significantly improved by implementation of intranet e-mail functions into the communication. This significantly improves the readability of data and messages and also the transfer speed and handling and filing of documents. The availability of the intranet function also gives access to

the data base available on site. To the extent necessary, personnel have been dedicated to positions to type in the data. The fax system is available as a backup system for information transfer. Due to exercise experience the new system is judged very positive and efficient by the staff of the centres in charge. The team considers this improvement of information transfer to be a significant improvement for plants, which do not have a direct data transfer (SPDS) to the management centre. A medical station is available on site which allows for medical treatment and has dedicated decontamination facilities to handle a combination of an injury and contamination. A fall back centre exists off site to host staff evacuated in case of an emergency. Busses will be available to transfer people to the fall back centre. Gathering points are implemented to collect and to account for personnel. These points are suitably located. They are equipped to measure the dose rate and the contamination, but do not provide for detection of airborne concentration of radionuclides. The team made a suggestion in this area.

Emergency response facilities of the regional authorities and of the corporate organisation are exceptional. A technical support centre for the authorities on a national level is available. Both national centres have access to the plant data in case of an emergency and in parallel are provided with regular messages issued by Tricastin NPP.

The centre of the fire brigade supporting Tricastin NPP in case of a fire has good equipment covering all needs of intervention and through the regional co-ordinating centre can be supported by other fire brigades in the area.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

Tricastin NPP has a mobile compressor and special shielding material available which consists of large concrete blocks which weigh 5 to 10 tons. Hydrogen combiners are stored at another power station and may be transferred to the site if needed. The equipment on site is adequately stored and maintained. Access to the storage area on site is ensured by painted warning information on the access roads to the mobile compressor. As handling of the shielding material needs a fork lift and is delicate due to the need to position the heavy blocks exactly in a quite narrow dedicated area inside the plant, Tricastin NPP has installed a mock up area for training outside to allow the training of staff. This practice eliminates the need to enter the controlled area and therefore does not endanger the plant or staff. The team considers this to be a good practice.

8.6. TRAINING, DRILLS AND EXERCISES

Training on emergency tasks in Tricastin NPP is based on the document defining the specific profile for on call people in the different Postes de Commandement, the competencies necessary to perform the tasks and the knowledge and training required in the different positions. Four specific training sessions and a refresher training have been developed to fulfil the training demand of the staff for their tasks in a crisis. Instructors are specialised for this training.

For personnel in charge of communication with the media, special training is provided on the corporate and local levels.

Tricastin NPP has implemented a very ambitious programme of exercises on site to test the performance of the crisis organisation and the staff in charge of tasks in the organisation. The intention is to assure that all staff members of the crisis organisation are engaged in an exercise each year to obtain good expertise and feedback of the organisation. The number of exercises

performed is considered a good way to ensure the best performance of the emergency preparedness organisation and to gain feedback for improvement.

A comprehensive effort is also implemented by the corporate level of EDF on big exercises. For 2002, thirteen exercises are planned to be performed over the EDF fleet. EDF aims to have one big exercise every three years for each plant.

8.7. LIAISON WITH PUBLIC AND MEDIA

To inform the public on the need for emergency preparedness, a leaflet was distributed in 1993. To account for the changes implemented to improve the protection of the public (see chapter 8.2), a new leaflet is planned to be distributed in March 2002.

Additionally to this pre-information, Tricastin NPP and the corporate level of EDF make a significant effort to keep the public and the media informed about ongoing activities in the plant and in EDF. Information on details such as routine releases, events in the plant and performances of the plant are published. A free telephone system has been set up by Tricastin NPP to answer questions and to give information to the public. Media coverage is monitored by the organisations in an effort to be proactive.

Special dedicated personnel are available on a local and corporate level that are specially trained to work with media representatives. An effort has been taken on a corporate level to set up an impressive information centre with professional tools to inform the media and in this way the public. The team considers the efforts taken as good performance of the corporate organisation and a good tool to support the local organisation.

During the review it also was recognised that local authorities are very eager to inform the public and to improve information transfer.

STATUS AT OSART FOLLOW-UP VISIT

The OSART mission offered three suggestions in the area of Emergency Planning and Preparedness. The follow up team found that the plant has responded accurately to these issues and judged them all as resolved.

The plant has made an agreement with the neighboring industries in the Tricastin nuclear complex that guaranties a rapid alert and a flow of information in case of an emergency situation. The simultaneous warning system has been tested during an exercise and is regularly tested the first Wednesday of every month.

All action sheets used during emergencies have been reviewed and include now fields to record when an action has been taken, who has requested the action and ticked off by the person that has done it or the assigned record keeper.

Furthermore, every muster point is now equipped with apparatus to measure dose rates and contamination.

Worthy of mention is also the fact that the two above actions are now part of the new corporate reference documents for Emergency Planning and Preparedness.

DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

8.2. EMERGENCY PLANS

8.2(1) Issue: It is not assured that the plant is quickly informed (e.g. within less than 15 minutes) of an accidental release in one of the nearby chemical plants.

Tricastin NPP is surrounded by several chemical plants with potentially hazardous materials and accounts for this by a special emergency plan. However, the plant does not routinely identify incoming hazardous chemicals released from these plants. Although, to cope with the hazards from chemical accidental releases of the surrounding chemical plants, the plant has filters for the incoming air and has implemented emergency procedures to be followed by the staff in case of UF6 and hazardous chemicals endangering the plant. The measuring vehicles used during accidents are equipped with measurement devices to measure hazardous chemicals. Additionally, an agreement on information in case of an accident has been signed with COGEMA. This agreement, however, does not assure that the plant is quickly informed about an accidental release. Due to lack of fixed installed detectors for hazardous chemicals it is not possible for the plant to detect such chemicals routinely.

Not being quickly informed about a release of hazardous material, could prevent the plant from implementing emergency countermeasures at the appropriate time to protect individuals at the plant

Suggestion: The plant should consider further measures to assure that it is quickly informed about any accidental release in one of the neighbouring chemical plants.

Plant Response/Action:

The rapid flow of information among the various sites on the Tricastin Nuclear Complex is now guaranteed by the simultaneous triggering of off-site emergency sirens.

The associated organisational measures are described in an agreement concerning off-site emergency sirens, signed by EDF and FLS COGEMA (the central alerting point for the AREVA industrial group). Manual sirens will be triggered automatically at the end of 2003.

The simultaneous warning system was tested during the national emergency drill on January 21st 2003.

Involving the public authorities, this drill also provided the opportunity to clarify the consistency of on-site emergency plans among the various Tricastin nuclear sites.

As a result, the EPP agreement will be re-drafted after members of the AREVA industries group have made the necessary adjustments (deadline: end 2003).

IAEA comments:

The plant has made an agreement with the neighbouring industries in the Tricastin nuclear complex that guarantees a rapid alert and a flow of information in case of an emergency situation. The simultaneous warning system has been tested during an exercise and is regularly tested the first Wednesday of every month.

Conclusion: Issue resolved

8.3. EMERGENCY PROCEDURES

8.3(1) Issue: The actions sheets used in the Poste de Commande (PC) do not provide a way to indicate which actions have been performed.

Emergency action sheets, which are used in the Poste de Commandement (as for example e.g. the Local Management Command Centre (PCD) and the Local Assessment Emergency Centre (PCC)) should guide the staff to the actions to be performed and should document that actions were performed. Some of these sheets are used recurrently to ensure proper actions. The action sheets do not provide a way to indicate, which actions have been taken. In this case an action to be performed might be missed.

Missing an action in the work of a Poste de Commandement in case of an accident may result in a poor performance to protect the public, the plant personnel or the plant.

Suggestion: Consideration should be given to improve the plant action sheets in a way to indicate that actions have been performed and when they were performed.

Plant Response/Action:

All our emergency action sheets have been reviewed as part of the process to implement the new set of corporate EPP reference documents. They now include a space for ticking off actions that have actually been performed. There is also a space reserved for indicating the time at which the action was performed.

Corporate EPP reference standards include a requirement to fill in a log book in each PC.

It tracks the important phases of actions carried out or requested by the PC. It can be used to track the information necessary for turnovers and will be used subsequently for experience feedback.

The new EPP organization since 26/6/2003 takes into account the corporate requirement on the strengthening of the PCD with a technical assistance person (PCD2.1) and a person (PCD3) whose job will be exclusively to fill in the log book and white board.

IAEA comments:

All action sheets have been reviewed and include now fields to record when an action has been taken, who has requested the action and ticked off by the person that has done it or the assigned record keeper.

Worthy of mention is also the fact that this is part of the new corporate reference documents for Emergency Planning and Preparedness.

Conclusion: Issue resolved

8.4. EMERGENCY RESPONSE FACILITIES

8.4(1) Issue: The plant does not provide means to quickly determine the concentration of airborne radioactivity at sites where workers gather during emergencies.

For rapidly developing emergency scenarios the concentration of airborne radioactivity may quickly rise in the plant and at the gathering points for plant workers. Under these conditions it is necessary to quickly determine the airborne contamination levels so that proper actions can be taken. Additionally, higher airborne concentrations may result in the transfer of airborne material into the emergency building.

Presently, in case of an accident, staff will preferably be sent to the upwind gathering stations and a measuring vehicle will determine the airborne concentration on site. There are no continuous air monitors available at emergency gathering points.

Lack of continuous update of information on the airborne concentration and of protection from inhalation and contamination may result in reduced protection and increased exposure of the staff in case of an accident.

Suggestion: The plant should consider ways to provide means to quickly determine the concentration of airborne radioactivity at sites where workers gather during emergency.

Plant Response/Action:

Corporate EPP reference standards require radiological conditions (atmospheric gamma dose rate) to be checked approximately every ½ hour, the values measured to be recorded and all anomalies to be noted.

The head of PCM warns those in charge of the muster points of the potential risks. After consultation between the PCD and the head of PCM, the person in charge of a muster point transfers the muster point when the following criteria are exceeded:

- Due to atmospheric conditions in a given area, it is no longer possible to check for body contamination.
- In the nuclear auxiliary building changing-room: dose rate >25µSv/h
- At other emergency muster points: dose rate > 7.5 µSv/h

Every muster point has been equipped with apparatus designed to measure dose rate and contamination in that area, as well as an electronic dosimeter and a control film badge.

To determine the collective dose, the head of the muster point uses the electronic dosimeter and the control film badge.

The first test on the use of the plant public address system, carried out during an EPP drill on 21/1/2003, was used to gauge the effectiveness of the information transmitted to muster points.

IAEA comments:

Every muster point is now equipped with apparatus to measure dose rates and contamination. This is now a part of the practice in the new EDF corporate reference documents for Emergency Planning and Preparedness.

Conclusion: Issue resolved.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

8.5(a) Good Practice: For Accident management measures, special shielding devices are necessary to be implemented in a controlled area in the plant. This needs to handle very heavy concrete block of weights ranging from 5 to 10 tons by a forklift in a very narrow area to precisely position them as radiation protection shielding. To facilitate the training of staff, the plant has prepared a special dedicated out side area to give the staff the possibility to train without interfering the operation of the plant and without the hazard of damaging equipment inside the plant during training. This area is used up to 12 times a year to get persons used in setting up the device. Using dedicated training areas for special training of accident management material will enable the staff to get more practice easily and with less effort and especially without endangering the plant. It is considered a good practice and is recommended for other plants with similar accident management provisions.

SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS

OF THE OSART FOLLOW UP MISSION TO TRICASTIN NPP

17-21 NOVEMBER 2003

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	WITHDRAWN	TOTAL
Management, Organization and Administration	R 2	R 4			R 6
Training and Qualification	S 2				S 2
Operations	R 2	R 4 S 1			R 6 S 1
Maintenance		R 2			R 2
Technical Support	R 1 S 1	R 2 S 1			R 3 S 2
Radiation Protection	S 2	R 1			R 1 S 2
Chemistry	R 1 S 2				R 1 S 2
Emergency Planning and Preparedness	S 3				S 3
TOTAL R (%)	R (32%)	R (68%)			R (100%)
TOTAL S (%)	S (83%)	S (17%)			S (100%)
TOTAL (%)	(52%)	(48%)			(100%)

DEFINITIONS

DEFINITIONS - OSART MISSION

Recommendation

A recommendation is advice on how improvements in operational safety can be made in the activity or programme that has been evaluated. It is based on proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often illustrates a proven method of striving for excellence which reaches beyond minimum requirements. Recommendations are specific, realistic and designed to result in tangible improvements.

Suggestion

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes or to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

Good Practice

A good practice is a proven performance, activity or use of equipment which the team considers to be markedly superior to that observed elsewhere. It should have broad application to other nuclear power plants and be worthy of their consideration in the general drive for excellence.

DEFINITIONS - FOLLOW-UP VISIT

Issue resolved - Recommendation

All necessary actions have been taken to deal with the root causes of the issue rather than to just eliminate the examples identified by the team. Management review has been carried out to ensure that actions taken have eliminated the issue. Actions have also been taken to check that it does not recur. Alternatively, the issue is no longer valid due to, for example, changes in the plant organization.

Satisfactory progress to date - Recommendation

Actions have been taken, including root cause determination, which lead to a high level of confidence that the issue will be resolved in a reasonable time frame. These actions might include budget commitments, staffing, document preparation, increased or modified training, equipment purchase etc. This category implies that the recommendation could not reasonably

have been resolved prior to the follow up visit, either due to its complexity or the need for long term actions to resolve it. This category also includes recommendations which have been resolved using temporary or informal methods, or when their resolution has only recently taken place and its effectiveness has not been fully assessed.

Insufficient progress to date - Recommendation

Actions taken or planned do not lead to the conclusion that the issue will be resolved in a reasonable time frame. This category includes recommendations on which no action has been taken, unless this recommendation has been withdrawn.

Withdrawn - Recommendation

The recommendation is not appropriate due, for example, to poor or incorrect definition of the original finding or its having minimal impact on safety.

Issue resolved - Suggestion

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been fully implemented or the plant has rejected the suggestion for reasons acceptable to the follow-up team.

Satisfactory progress to date - Suggestion

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been developed but not yet fully implemented.

Insufficient progress to date - Suggestion

Consideration of the suggestion has not been sufficiently thorough. Additional consideration of the suggestion or the strengthening of improvement plans is necessary, as described in the IAEA comment.

Withdrawn - Suggestion

The suggestion is not appropriate due, for example, to poor or incorrect definition of the original suggestion or its having minimal impact on safety.

ACKNOWLEDGEMENT

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TEAM COMPOSITION OSART MISSION

HANSSON, Bertil

IAEA

Years of Nuclear Experience : 34

Team Leader

COOK John

IAEA

Years of Nuclear Experience: 31

Assistant Team Leader

EVANS Ian

UK

Years of Nuclear Experience: 28

Review Area: Management Organization and Administration

CLARK Russ

IAEA

Years of Nuclear Experience: 20

Review Area: Training and Qualification

SÄMGÅRD Jan

Ringhals Nuclear Power Plant, Sweden

Years of Nuclear Experience: 25

Review Area: Operations 1

BARRERA Fernando

Laguna verde NPP, Mexico

Years of Nuclear Experience: 23

Review Area: Operations 2

NICOLÁS Pedro

Central Nuclear Vandellos II, Spain

Years of Nuclear Experience: 19

Review Area: Maintenance

GOODMAN Robert
Ontario Hydro Ltd., Canada
Years of Nuclear Experience: 24
Review Area: Technical Support

BROCKMAN, K. - USA
USNRC
Years of Nuclear Experience: 23
Review Area: Radiation Protection

SHEJBAL Jaromir
Jaderna Elektrarna Dukovany, CZR
Years of Nuclear Experience: 21
Review Area: Chemistry

PFEFFER R-W.
Gesellschaft für Anlagen und Reaktorsicherheit (GRS)mbH, Germany
Years of Nuclear Experience: 22
Review Area: Emergency Planning and Preparedness

OBSERVERS

ULLAH KHAN, Asad
Chashma Nuclear Power Plant, Pakistan
Years of Nuclear Experience: 19

XIE, Jiajie
Third Qinshan Nuclear Power Company Ltd
People's Republic of China
Years of Nuclear Experience: 16

NOCTURE Pierre
IAEA
Years of Nuclear Experience: 17

TEAM COMPOSITION OSART FOLLOW UP VISIT

HANSSON, Bertil

IAEA

Years of Nuclear Experience : 36

Team Leader

Review Area: Management Organization and Administration

COOK John

IAEA

Years of Nuclear Experience: 33

Assistant Team Leader

Review Areas: Technical Support
Radiation Protection

NICOLÁS Pedro

Central Nuclear Vandellos II, Spain

Years of Nuclear Experience: 19

Review Area: Maintenance
Chemistry

EVANS Ian

UK

Years of Nuclear Experience: 30

Review Area: Training and Qualification
Operations
Emergency Planning and Preparedness